THE MARINE REVIEW

VOL. XXXIII. CLEVELAND, APRIL 26, 1906. No. 17.

SHIP BUILDING IN THE UNITED KINGDOM.

From the returns compiled by Lloyds register of shipping it appears that, excluding warships, there were 547 vessels of 1,401,882 tons gross under construction in the United Kingdom at the close of the quarter ended March 31. The tonnage under construction has shown a steady incr with whi retu crease of 46,000 tons, while the total for September, 1905, is now exceeded by over 76,000 tons. Of the vessels under construction in the United Kingdom at the end of March, 427 of 1,028,144 tons are under the supervision of the surveyors of Lloyds register, with a view to classification by this society. In addition 63 vessels of 158,571 tons are building abroad with a view to classification. The total building at the present time under the supervision of Lloyds register is thus 490 vessels of 1,186,715 tons. Details of this are as follows: Building in United Kingdom for foreign and colonial account 65, gross tonnage, 140,176 tons; building abroad for United Kingdom owners, 7, gross tonnage, 1,140 tons; building abroad for

Mr. J. C. Evans, western manager of the Anchor line, made the trip as far as Cleveland on the package freight steamer Tionesta on her first trip this season.

The Canadian steamer Donneconna, which stranded near Sault Ste. Marie, Mich., was released after 5,000 bu. of her grain cargo had been lightered.

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SCIENTIFIC LAKE NAVIGATION.

By Clarence E. Long.

DIVISION.

The process of finding how many times one number is contained in another is called *division;* or,

Division is the process of separating a number into equal parts.

The number to be divided is called the *dividend.*

The number by which we divide is called the *divisor.*

The result obtained by division is called the *quotient.* It shows how many times the divisor is contained in the dividend.

The part of the dividend remaining when the division is not exact is called the *remainder.*

Division is also indicated by writing the dividend above the divisor. Thus, $\frac{63}{9}$ indicates that 63 is to be divided by 9.

When the dividend and divisor are like numbers, the quotient must be an abstract number.

The dividend and remainder are like numbers.

The product of the divi[illegible]

Find how many times 16 is contained in 180°

Divisor. Dividend. Quotient.

16) 180° (11° 15′

— 16

20°

— 16

4° = 240′

— 16

80′

— 80

Answer 11° 15′.

Note.—Multiply the divisor by the quotient, and to the product add the remainder, if any. If the work is correct, the result will equal th[illegible]

[illegible]ith a
[illegible]ltiply
[illegible]duct,
[illegible] into

Write the divisor at the left of the dividend with a curved line between them. Then divide the highest denomination by the divisor, writing the quotient to the right of the dividend with a curved line between them, and any number of degrees, minutes or seconds, as the case may be, left after the subtraction has been made convert same into the next lower denomination by multiplying by 60, add the product thus obtained to the denomination to which reduced and divide and reduce as before, &c., thus:

[illegible] minutes; then add the 23′ to the 180′ thus obtained and divide the sum 213′, which is the next dividend, by the divisor, 4; thus, 4 is contained in 213′ 53 times, or 53′, with a remainder of 1′. Write this 53′ in the quotient and multiply the divisor 4 by this quotient figure, and subtract the product, and the remainder 1′ convert into seconds and add the 56″ thereto, and the sum 116″ divide by the divisor 4, which it contains 29 times, or 29″. Write this 29″ in the

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quotient, and multiply the divisor 4 by this quotient figure, and the product comes even.

Division of °, ′, ″, ‴, is practically multiplication work backwards. In multiplication you start with the lowest denomination and multiply, then you divide and subtract; in division you start with the greatest denomination and divide, then subtract and multiply. Remember, that 4° and 240′ is the same thing. Now, if you were to divide 4° by 8 you couldn't do it until the 4° was reduced to a lower denomination. 1° = 60′, and 1′ = 60″, and 1″ = 60‴, etc. 1° 20′ is 80′, or 480″, or 2,880‴. Just the same as 60 minutes of time make 1 hour, and 60 seconds of time 1 minute.

Examples for practice. Find the *quotient* in each case.

Divide 360° by 32. Ans. 11° 15′
180÷16. Ans. 11° 15′.
11° 15′ ÷ 2. Ans. 5° 37′ 30″.
5° 37′ 30″ ÷ 2. Ans. 2° 48′ 45″.
2° 48′ 45″ ÷ 2. Ans. 1° 24′ 22″ 30‴.
56° 15′ ÷ 5. Ans. 11° 15.
90° ÷ 8. Ans. 11° 15.
67° 30′ ÷ 6. Ans. 11″ 15.
21° 42′ 50″ ÷ 4. Ans. 5° 25′ 42″ 30‴.
187° 46′ ÷ 7. Ans. 26° 49′ 25″ 42 6-7‴.
37° 15′ 28″ ÷ 5. Ans. 7° 27′ 5″ 36‴.
137° 48′ 24″ ÷ 3. Ans. 45° 56′ 8″.

Learn these thoroughly:

The *sum* or *amount* is the number obtained by adding two or more numbers together.

The *difference* or *remainder* is the result or answer obtained by subtracting.

In subtraction the *minuend* is the greater of the two numbers, and the *subtrahend* is the smaller of the numbers.

The *product* is the result or answer obtained by multiplication, and the *multiplicand* is the number to be multiplied, and the *multiplier* the number by which to multiply.

In division the *quotient* is the result or answer of the division, the *dividend* is the number to be divided, and the *divisor* the number by which to divide.

It is necessary to know these terms in order to thoroughly understand the meaning of the various rules given above.

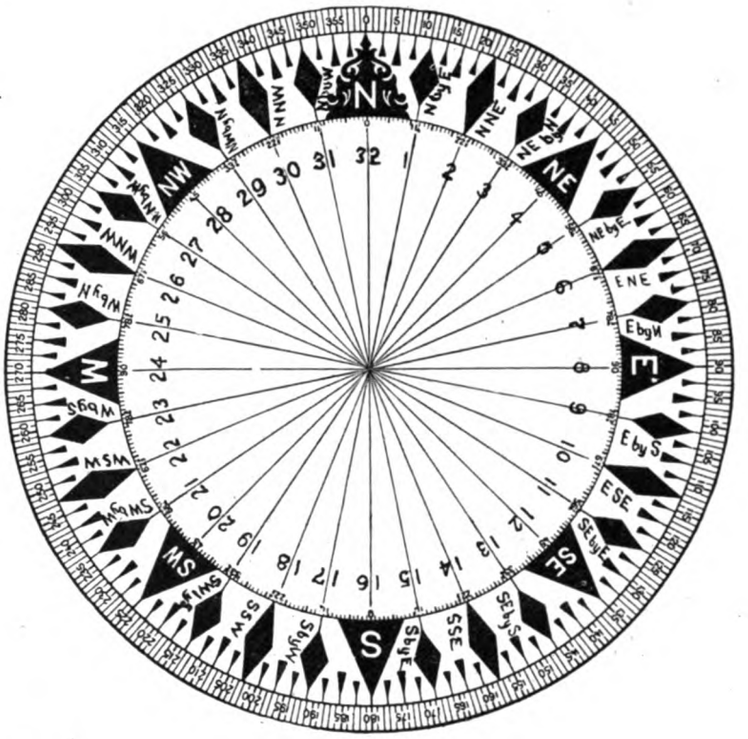
To compile a table of angles corresponding to every point and fractional point of the compass:

The pupil should now be able to compile a table showing the °, ′, ″ corresponding to each point and quarter point on the face of the compass, that is, the angle any point of the compass, or course on the compass, makes with either North or South, the meridian, or reckoning points of the compass. For example, NNE is an angle of 2 points, or 22° 30′, or 22½° from North. NNW is the same thing, as are also SSE and SSW; the two latter being reckoned or measured from South. The greatest angle that you can have for any course is 90°, or 8 points, which correspond to East and West.

You may now write down the names of the points and quarter points of the compass—the method known as boxing the compass—from North to East. If you do not know their names off-hand, copy them from the accompanying illustrated compass diagram. Next figure out the number of degrees, minutes and seconds corresponding to each angle, that is, to each full and fractional point. Remember, that any angle can be measured in points and fractions of a point, as well as by °, ′ and ″.

Here is the way to start the figuring:

Compass Pts. 32) 360° (11° 15′ = 1 point.
— 32
40°
— 32
8° = 480′
— 32
160′
— 160
2) 11° 15′ (5° 37′ 30″ = ½ point.
— 10
1° = 60′ +
75′
— 6
15′
— 14
1′ = 60″
— 6
0
2) 5° 37′ 30″ (2° 48′ 45″ = ¼ point.
4
1° = 60′ +
2) 97′
— 8
17′
— 16
1′ = 60″ +
90″
— 8
10
— 10
2° 48′ 45″ = ¼ point.



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× 3

6° 144′ 60) 135″ (2′
+ 2° + 2′ — 120

8° 60) 146′ (2° 15″
— 120

26′

Answer 8° 26′ 15″ = ¼ of a point.

Or, thus,

11° 15′ 00″ = 1 point.
— 2° 48′ 45″ = ¼ point.

8° 26′ 15″ = ¼ point.

How to start the table of angles:

North	0°	0′	0″
N ¼ E	2°	48′	45″
N ½ E	5°	37′	30″
N ¾ E	8°	26′	15″
N by E	11°	15′	and so

on the whole way through.

The angles corresponding to the names of the points and quarter points in the remaining three quadrants are identical, namely: N by W is N 11° 15′ W, S by E is 11° 15′ E, and S by W is S 11° 15′ W, and so on with every point and quarter point of the compass.

Note.—If you go all the way round the compass to the right ("boxing the compass") from north, bear in mind that between east and south you must reckon from S towards E instead of E towards S. For example, E ¼ S in degrees is not E 2° 48′ 45″ S, but S 87° 11′ 15″ E. The same thing is true, between west and north in working continuously to the right. North and south are the zero points and all courses are reckoned from them, toward east and west up to 90°. This is fully explained in Lesson II.

Note.—Here is another way of getting at it. After determining the number of degrees, minutes and seconds in a quarter of a point, keep adding the number of degrees and fractions of a degree to a quarter, half, three-quarters, a point, and so on till you get 90°, the required amount.

Here is the way to do it:

2° 48′ 45″ = ¼-pt.
¼-pt. + 2° 48′ 45″

5° 37′ 30″ = ½-pt.
¼-pt. + 2° 48′ 45″

8° 26′ 15″ = ¾-pt.
¼-pt. + 2° 48′ 45″

11° 15′ 00″ = 1-pt.
¼-pt. + 2° 48′ 45″

14° 3′ 45″ = 1¼-pt.
¼-pt. + 2° 48′ 45″

16° 52′ 30″ = 1½-pt.
¼-pt. + 2° 48′ 45″

19° 41′ 15″ = 1¾-pt.
¼-pt. + 2° 48′ 45″

22° 30′ 00″ = 2-pt. and so on up to 90°.

Learn how many degrees, minutes and seconds in a quarter, half, three-quarter and a whole point. The remainder of them will come to you as you progress and have occasion to use them. Examples:

How many °, ′, ″, ‴ in ⅛ of a point? Ans. 1° 24′ 22″ 30‴.
How many in ⅜ of a point? Ans. 4° 13′ 7″ 30‴.
How many in ⅝ of a point? Ans. 7° 1′ 52″ 30‴.
How many in ⅞ of a point? Ans. 9° 50′ 37″ 30‴. How to get them:

Dividing 11° 15′ by 8 will give the number of °, ′, ″, ‴ in ⅛-point. Multiply this by 3 gives it for ⅜; by 5 for ⅝ and by 7 for ⅞.

Or, if the °, ′, ″, ‴ that equal ⅛-point be added to the °, etc., that correspond to ¼-point will give the °, etc., corresponding to ⅜-point, and so on with the half for ⅝; the three-quarters for ⅞, etc.

From N. to E.	Points.	Degrees.		
NORTH	0	0°	00′	00″
N ¼ E	¼	2°	48′	45″
N ½ E	½	5°	37′	30″
N ¾ E	¾	8°	26′	15″
N by E	1	11°	15′	00″
N by E ¼ E	1¼	14°	03′	45″
N by E ½ E	1½	16°	52′	30″
N by E ¾ E	1¾	19°	41′	15″
N N E	2	22°	30′	00″
NNE ½ E	2½	28°	07′	30″
NNE ¼ E	2¼	25°	18′	25″
NNE ¾ E	2¾	30°	56′	15″
NE by N	3	33°	45′	00″
NE ¾ N	3¼	36°	33′	45″
NE ½ N	3½	39°	22′	30″
NE ¼ N	3¾	42°	11′	15″
N E	4	45°	00′	00″
NE ¼ E	4¼	47°	48′	45″
NE ½ E	4½	50°	37′	30″
NE ¾ E	4¾	53°	26′	15″
NE by E	5	56°	15′	00″
NE by E ¼ E	5¼	59°	03′	45″
NE by E ½ E	5½	61°	52′	30″
NE by E ¾ E	5¾	64°	41′	15″
ENE	6	67°	30′	00″
ENE ¼ E	6¼	70°	18′	45″
ENE ½ E	6½	73°	07′	30″
ENE ¾ E	6¾	75°	56′	15″
E by N	7	78°	45′	00″
E ¾ N	7¼	81°	33′	45″
E ½ N	7½	84°	22′	30″
E ¼ N	7¾	87°	11′	15″
EAST	8	90°	00′	00″

The above table shows the names of the points and quarter points, number of the points and fractional points in each course, and the angle, or degree divisions, made by each with the meridian North, from North to East on every compass card. This portion of the table is given here merely to assist the beginner.

POINTS AND DEGREES OF THE COMPASS.

The above picture represents the card of a Mariner's Compass together with the degrees and points of the circle. The circumference is marked, commencing with North, from 0° to 360°, continuously to the right—0° and 360° coinciding with each other. The radial lines marked from 1 to 32, represent the full points. The 32d point corresponds to North, or zero being one and the same. 16 points is South, or 180 degrees. The 24th point corresponds to West, or the 270th degree, etc. The inner circle graduated to degrees corresponds to the usual method of marking the card; namely, N and S 0°, and E and W 90°. The reverse points are marked alike—N by E, S by W—N by W, S by E, are each marked 11¼. These are called the 1 point courses, because they lie one point from the zero, or reckoning points North and South. There are, therefore, 4 of every kind of point courses with the exception of the two meridian courses

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N and S, and two 8-point courses E and W, all of which is explained in Lesson 11.

The letters placed alongside the full point is the abbreviated name belonging thereto, and should be read in full; thus, N by E is north by east; NNE, north-northeast, etc.

Mariner's Compass, the compass used by navigators. It has one or more (the modern compass contains from 6 to 8 bundles of fine steel wires, highly magnetized, laid parallel with one another), magnetic needles, attached to a circular card, which is free to turn upon the point of a steel cone, or pivot, rising from the bottom of the bowl, or, in good modern instruments, floats on a liquid—spirits, or oil (benzine). On the upper surface of the card are marked the 32 full and fractional points (also, sometimes the degrees corresponding therewith) of the compass. The compass is read (the direction in which the ship is heading) with reference to a mark (a vertical black line, for'ard, on the inside of the bowl, called the Lubber's Point) which represents the ship's head.

EIGHTH POINTS.

Point of the Compass, one of the 32 equidistant directions, or division-points marked on the card of the mariner's compass, or a corresponding point in the horizon, or vertical plane passing through the horizon and one such points. The corresponding points by which the circle is supposed to be divided, of which the four marking the directions of East, West, North and South, are called *cardinal points;* and the rest are named from these directions, as NE takes its name from the two cardinal points between which it is equidistant. NE, SE, SW and NW are called *inter-cardinal points* for this reason. The point lying midway between N and NE takes its name from the nearest cardinal point (north) and the adjacent inter-cardinal point (NE), hence its name, NNE (north-northeast,) etc.

Compass Card, the circular card attached to the magnetized needles of a Mariner's Compass, on which are marked the thirty-two points, or rhumbs, their fractional parts and the degrees of the circle, all about which is explained in another lesson.

REDUCTION OF FRACTIONS.

2-8 is the same thing as ¼, and when it is reduced to its lowest terms is ¼.

4-8 is the same thing as ½, and when it is reduced to its lowest terms is ½.

6-8 is the same thing as ¾, and when it is reduced to its lowest terms is ¾.

8-8 equals 1-1 and 1-1 equals 1.

4-4 and 8-8 = a whole one.

¼ and 3-12 are one and the same; 3-12 reduced equals ¼. 6-12 = ½; 9-12 = ¾; 12-12 = 1-1 = 1.

1-3 and 4-12 are equal; 4-12 reduced equals 1-3; 8-12 = 2-3. 2-12 = 1-6; 10-12 = 5-6.

4-4 and 12-12 and 3-3 are equal and represent a unit of anything.

Note.—Any fraction whose numerator and denominator are the same, equals a whole one.

DOCK YARD EXTENSION AT PORTSMOUTH.

Under the naval works act of 1895 a great scheme of dock yard extension has been carried out at Plymouth, which will add greatly to Britain's naval resources. The new works embrace a tidal basin, entered from the Hamoaze, a large closed basin with entrance lock, and three dry docks. Covering an area of 35½ acres, the closed basin has a depth of 32 ft. 6 in. of water at low tide. With a quayage of 4,500 ft., the closed basin will accommodate five of the largest battleships afloat at the same time, while it is to be equipped with the most up-to-date machinery for warship construction and repair. The tidal basin is 10 acres in area, with a depth of 32 ft. at low water, and has a length of quayage of 2,100 ft. The smallest of the three docks has a length inside caissons of 480 ft., and a depth of 32 ft. on its sills. This dock can be entered only from the closed basin. The other docks are respectively 745 ft. long, with a depth of 32 ft. of water, and 741 ft. long, with a depth of 44 ft. Situated between the closed and tidal basins these docks have entrances from both, and can be used also as locks for the passage of vessels to and from the closed basin. They are also provided with center caissons so that two cruisers of the smaller class can be repaired in each at the same time. The entrance lock by which ships can be taken direct from the Hamoaze into the closed basin is 730 ft. between caissons, and can also be used as a dock in case of emergency. The entrances all have a width of 95 ft., and floating caissons at either end will enable the two larger docks to be extended nearly 100 ft. in length. With the basins, docks and workshops the extension works cover an area of 114 acres. Necessarily so great a task has involved the handling of great masses of material. The works extend for a considerable distance along the upper foreshore of the harbor, and no less than 10,000,000 tons of mud, earth, and rock have been excacated in the construction of the locks, basin and seawall. Nearly all this debris has been taken out to sea and deposited in the channel some miles off the port.

ANNUAL REPORT CUNARD CO.

The annual report of the Cunard Steamship Co. shows that the profits for the year 1905, including £7,429 17s 11d brought forward from 1904 amount to £322,212 7s 8d. After debiting interest, reserving £182,061 13s 2d for depreciation of ships and wharf properties, transferring £2,669 9s 1d to the insurance fund, and £50,000 to reserve fund, there remains at the credit of profit and loss account £71,285 16s 1d, out of which the directors recommend the payment of a dividend at the rate of 4 per cent per annum, free of income tax, or the paid up capital of the company, carrying forward the balance of £7,285 0s 1d to next year's account. The balance at the credit of the insurance fund stands at £380,000, and the reserve fund has been increased to £150,000. The report goes on to say that the war of rates terminated early in 1905, and passenger fares have since been at normal figures. Freights outwards to the United States were fairly well kept up during 1905, and during the last few months of the year homeward business was much improved. There was as great change in passenger business. Emigration was large, but there was a falling off in third class traffic eastbound. The directors report that the Carmania was received from the builders in November, and has since been running successfully and regularly in the New York service. This is all the information that is given regarding this important turbine steamer, but it is sufficient to know officially that the Carmania is a success. The report also says that the two new fast steamers which are being built under the agreement with the British government are making good progress.

The directors of Sir W. G. Armstrong, Whitworth & Co. have declared an interim dividend of ten per cent per annum on the ordinary shares and four per cent on the preference shares.

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INSTITUTION OF NAVAL ARCHITECTS.

The spring meetings of the Institution of Naval Architects were held in London on April 4, 5 and 6, presided over by the Right Hon. the Earl of Glasgow. The annual report of the council stated that the membership had increased in all classes, and was now 1,711 as compared with 1,632 in 1904. The Martell scholarship, which was competed for last spring, attracted a number of candidates from the principal ship building centers of the country, and was awarded to Mr. A. T. Wall, of Devonport dock yard, as the result of the board of education's examinations in the prescribed subjects. The reports received from the director of naval education upon the work of the previous Martell scholar, Mr. Lloyd Woollard, who completed his course at the Royal naval college, Greenwich, and had since been appointed to the construction department at the admiralty, had been most gratifying, and the council were encouraged to hope that the establishment of these scholarships would prove of lasting value both to the institution and the profession. This year's "Institution of Naval Architects" scholarship, the first of the two due to the liberality of Dr. Elgar and Mr. A. F. Yarrow, would be competed for shortly under very similar regulations to those of the Martell scholarship. The council had awarded the gold medal for the past year to Mr. W. W. Marriner, for his paper on "Deduction from Recent and Former Experiments on the Influence of the Depth of Water on Speed," and premiums to Mr. J. H. Heck for his paper on "The Variation of Angular Velocity in the Shafting of Marine Engines," and to Mr. Harold Yarrow for his paper on "The Effect of Depth of Water on Speed."

The Earl of Glasgow in the course of his presidential address said that the well known turret deck type of ship seemed to be steadily gaining in favor with ship owners. The tendency to increase the size of steamers showed no signs of abatement. The Hamburg-American liner Amerika registered 22,724 tons, and the Carmania, about which so much interest attached on account of her turbine engines, was 19,594 tons gross. At the close of 1905 thirty-seven vessels of over 6,000 tons each were under construction, and eight of these were over 12,000 tons. Abroad, the increased activity in ship building has been almost as marked as in Britain. The output from the German yards was again very large, and the growth of the industry in that country was well illustrated by the figures of the Norddeutscher Lloyd company, which showed that while the company's tonnage had more than trebled in the past fourteen years, the proportion of German built ships in that fleet had risen during that period from 30 to 80 per cent. In France, however, the depression of the past few years was still apparent in the ship building returns, and the output of mercantile tonnage shows unbroken shrinkage since 1902. New proposals were under consideration in the French legislature to remedy this state of affairs, and their effect, if adopted, will be followed with interest.

In the British parliament this session, a bill has been brought in to modify some features of the merchant shipping acts, based on the reports of certain committees that have been inquiring into the working of these acts at the present time. The bill is designed to remedy inter alia, the disabilities under which British ship owners have suffered in competition with foreign rivals in the matter of overloading. It is proposed that, after a reasonable lapse of time, foreign ships trading with this country should be subjected, where necessary, to the same regulations as are imposed upon British vessels in the matter of loading and safety appliances, thus abolishing the unfair advantages that have been hitherto enjoyed by foreign owned vessels. It would also be an object of the present bill to provide greater freedom in the future, to adapt the act to the varying conditions affecting the mercantile marine by allowing certain modifications by means of orders in council; and advisory committees would be created to report upon regulations that might appear from time to time to require adjustment. The favorable reception that the bill has met with from both sides of the house augurs well for the future, and it was confidently hoped that the measure would prove of real benefit to the welfare of the British mercantile marine.

The Earl of Glasgow then dealt with the output of marine engines, and said among the firms that had made substantial progress was the Parsons Marine Steam Turbine Co. who were credited with 50,000 I. H. P. for the past year. This total, however, was far from giving an idea of the advance made by the steam turbine as a means of ship propulsion. The largest engines of this type yet constructed had been or were being made in other works under license from this company. Thus the turbines for the Cunard liner, the Carmania, one of the largest ships in the world, were made in the works of the builders of the vessel on the Clyde, whilst the two new Cunarders, which will surpass any ship, will also have Parsons turbines constructed under license.

The rapidity with which the steam turbine had taken its place in the very front rank as a marine engine was, the president observed, unprecedented in the annals of the mercantile marine, but its progress in the Royal navy was no less striking. The Dreadnought, the largest battleship ever built was to be propelled by steam turbines, and the statement made by the first lord of the admiralty went to show that all vessels projected for this year are to be propelled by steam turbines. In conclusion the president said the council had under consideration the provision of an experimental tank, either as a central testing station for the use of ship builders wishing to try models for resistance, or as a place where scientific research into the various problems connected with ship resistance might be carried on. The provision of such a tank was of vital importance to the development of naval architecture on scientific lines.

WATER STORAGE OF COAL.

Important experiments are being carried on by the naval authorities at Portsmouth dock yard to ascertain to what extent the steaming properties of the Welsh coal used in the British navy are improved by storage in the sea. Eighteen months ago iron crates, each containing two tons of coal, were sunk in the big basin, and at the time a similar quantity of coal was carefully stored in the open air at the coaling point, and sheltered from the weather beneath tarpaulins. At intervals of six months, 2-ton samples from each storage have been taken out and carefully burned, and the results of the experiments have shown conclusively that by submarine storage of coal its calorific value steadily increases, while by storage in the open air a decided decrease is shown. At the naval coaling stations in the tropics this decrease in calorific value is very great, the sun's heat drawing all the light, volatile oils out of the coal. The admiralty having satisfied themselves of the physical and financial advantages of the storage of coal in the sea, have now directed that experiments be made to ascertain its practicability on a large scale.

The earnings of the Clyde Steamship Co. last year were $852,792 net.

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NEW WATER LIGHT.

Mr. Carl Virgin, general manager of the Marine Torch Co., Baltimore, Md., is at present in the great lakes district in the interest of the water light which is manufactured by this company. He has visited a number of vessel owners who are quite favorably impressed with the extraordinary merits of this light. A demonstration of it was given at No. 1 fire engine house, Cleveland, on Monday night to the entire satisfaction of the fire department, and it will be installed on the wagons for further experimental purposes. The gas for this light is generated by water and in combination with another element is also ignited by water. Nothing can extinguish it so long as there is water available. If completely submerged it instantly relights itself upon coming to the surface. It is very compactly carried in a can about 9½ in. high and 5 in. in diameter. Such a can has a capacity of about 300 candle power for one hour. The extraordinary utility of such a light in ship wreck or in time of distress is well understood. The water light has been generously adopted by the United States navy and is being installed on a great many wooden vessels. It has also been put aboard the fleet of the Merchants & Miners' Transportation Co. and the Bay line along the Atlantic coast. Chief Croker, of the New York fire department, ordered 500 of the lights at the first demonstration. The light is also put up in the form of an ordinary projectile so that it can be fired out of a gun any distance over land or sea. There is practically no limit to the utility of this light, as it is available both for railroad and steamship use as well as for use in emergency cases when no other light could possibly burn. The gas is non-explosive as there is never more than two ounces of pressure on the can. The Marine Torch Co. will send its literature descriptive of this light to anyone desiring it. Probably an experimental test will be held by some of the lake vessel owners within a few days.

LAUNCH OF THE J. PIERPONT MORGAN.

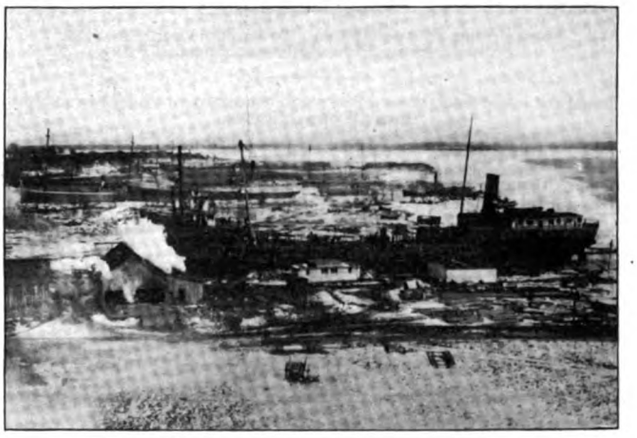
The freight steamer J. Pierpont Morgan, building for the Pittsburg Steamship Co. at the South Chicago yard of the American Ship Building Co., was launched promptly at noon on Saturday last and was christened by Miss Blanche Banks, daughter of the president of the Elgin, Joliet & Eastern railroad. Work was suspended for the day at the ship yard so that all employes might witness the launching and special trains from Chicago and Pittsburg took large numbers of railroad and steamship men to the plant. The J. Pierpont Morgan is a duplicate of the four steamers which were built last year for the Pittsburg Steamship Co. She is 600 ft. over all, 580 ft. keel, 58 ft. beam and 32 ft. deep, having thirty-six hatches spaced 12-ft. centers. She will be equipped with triple-expansion engines, cylinders 24, 39 and 65-in. diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 15 ft. 4 in. by 11 ft. 6 in., fitted with Ellis & Eaves draft and allowed 180 lbs. pressure. The H. H. Rogers, the second of the 600-footers building for the Pittsburg Steamship Co., will be launched from this yard in about a month. After the launching of the Morgan luncheon was served at the Auditorium annex and was attended by President Marvin Hughitt and Vice President McCullough, of the Chicago & Northwestern railway; President E. J. Buffington, of the Illinois Steel Co.; Mr. R. C. Wetmore, of the American Ship Building Co.; and Mr. Harry Coulby and A. F. Harvey, of the Pittsburg Steamship Co.

LAUNCH OF THE OGDENSBURG.

The first of the two package freighters building for the Rutland Transit Co., of Ogdensburg, was launched at the Cleveland yard of the American Ship Building Co. on Saturday last and was named by Miss Helen Owen, of Ogdensburg, grand-daughter of Mr. Frank Owen, general agent fo the line. The Ogdensburg is of Canadian canal size, being 256 ft. over all, 242 ft. keel, 43 ft. beam and 26½ ft. deep. She will be equipped with quadruple-expansion engines with cylinders 17½, 25½, 37 and 54 in. diameters by 36-in. stroke, supplied with steam from two Scotch boilers 12½ ft. diameter and 11½ ft. long, fitted with Ellis & Eaves draft. The Ogdensburg will be completed in about a month and the Rutland, her sister ship, building at the same yard, will be launched in about three weeks. Those on the launching stand with Miss Owen were: Mr. Frank Owen, Mr. H. H. Owen and Miss Boardman, of Ogdensburg; Mr. W. H. Cassidy, of Rutland, Vt.; Mr. W. J. Klingman, Mr. J. C. Wallace, Mr. W. C. Richardson, Mr. Robert Wallace and Mr. D. C. Tucker, local agent of the Rutland line.

BUSY REPAIRING WOODEN SHIPS.

Abram Smith & Son, Algonac, Mich., are extremely busy in making repairs and alterations to wooden boats. The following photograph of their plant at Algonac shows that they have good slips and abundant room for attending to lake vessels.



ABRAM SMITH & SONS' PLANT AT ALGONAC.

FIRST AMERICAN-BUILT TURBINE STEAMER.

The first turbine ship to be built in the United States was launched at Roach's Ship Yard, Chester, Pa., on Saturday last and was named the Governor Cobb. This steamer is building for the Eastern Steamship Co. of Boston, for the route between Boston and St. John. She is 300 ft. over all, 290 ft. on the water line, 51 ft. beam, 55 ft. beam over guards, 20 ft. 6 in. deep, load draught 14 ft. In outer appearance she is similar to the steam Governor Dingley and the Calvin Austin belonging to the Eastern Steamship Co. She is a double bottom steel ship, having main, saloon, guard and dome decks. She has accommodations for 175 staterooms and 200 berths. The dining room is on the mail deck over the quarter deck. The interest in this steamer is centered in her propelling power, which is to consist of Parsons steam turbines driving three screws, the center one being driven by the high pressure and the outside ones by the low pressure turbines. Steam will be supplied by six Scotch boilers. The W. & A. Fletcher Co., Hoboken, N. J., who are the contractors for the ship complete, are building the turbines. The contract for the hull was sublet to Roach's Ship Yard.

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THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published every Thursday by

The Penton Publishing Company

CLEVELAND.

CHICAGO: MONADNOCK BUILDING.
PITTSBURG: PARK BUILDING.
NEW YORK: 150 NASSAU STREET.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, $3.00 per annum. To Foreign Countries, $4.50. Subscribers can have addresses changed at will.

Change of advertising copy must reach this office on Thursday preceding date of publication.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C. England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

APRIL 26, 1906.

IMPROVEMENT OF WATERWAYS.

The present year will be rich in the number and variety of conventions which will be held in various parts of the country for the improvement of inland waterways. The National Rivers and Harbors Congress, which was organized in Washington last January, is proceeding upon a liberal scale to interest various sections in the supreme importance of waterways upon national life. The waterway is the natural avenue of transportation and yet how continuously it has been neglected by the United States government. It is a natural leveler of rates, and yet the government annually expends five times as much on its navy department as it does on its waterways. The mission of one is to destroy; the mission of the other is to upbuild. No money which the government invests pays such enormous dividends as does the money expended in the improvement of waterways. In his very interesting report filed with the war department, Major Charles L. Potter, government engineer at Duluth, computes that the saving in freight in shipments from the port of Duluth alone for the single year of 1905 was more than had been expended on the chain of lakes for waterway improvements since the foundation of our government. Surely with such returns as this congress should not be niggardly in dealing with waterways. The sum of $50,000,000 which the National Rivers and Harbors Congress set out to secure is none too great. When the annual appropriation for the improvement of waterways reaches $50,000,000 it will be seen that the freight rate will fall in proportion as waterways are improved.

Navigation on the lakes has opened with some surprises for the vessel owners. Stage of water is fully one foot less than it was last year, with the result that some of the vessels loaded to the usual draft have been brought up abruptly in the channels, and thus do the pioneers at every opening of navigation point out at their own cost the obstructions for others to avoid with profit.

AMERICA'S DUTY TO ITS MERCHANT MARINE.

A nation with a coast line should be self-contained in all things that pertain to the sea. Its maritime position should always be one of its chief concerns. It should not suffer any policy to continue that operates to lessen its maritime importance. It should maintain at all hazards many efficient ship building plants in order that its war fleet may be effectively built and rapidly replenished in case of need. Without an effective navy a nation with a coast line is in a bad way. It should also maintain a numerous merchant marine as the only natural cradle for its navy. If economic conditions operate to make the merchant marine a difficult thing to maintain, these conditions should be removed or compensated for. Such a condition obtains in the United States today and is responsible for the fact that the country has practically no merchant marine in the foreign trade. The policy of the American government is protective. This policy has been extended to every department of industry, but for some reason shipping has been excluded from it and is a tremendous sufferer thereby. If the country were on a free trade basis, shipping would have nothing special to complain of, because it would be meeting equal conditions. But the shipping of a protected country which is itself unprotected, has a double burden to bear. It cannot possibly compete with high priced vessels and high priced labor with low priced vessels and low priced labor. This is precisely the condition in the United States today. The shipping bill, which was drafted by the merchant marine commission after a most exhaustive inquiry, is sustained to remedy the ills set forth in this article. It should be passed. If it is not passed, there is no hope that the American flag can long survive.

SCIENTIFIC LAKE NAVIGATION.

The course of instruction in scientific navigation now running in the MARINE REVIEW under the direction of Mr. Clarence E. Long, will be continued throughout the year. The course will be unusually thorough, but everything will be subtracted from it that does not aid the lake navigator. All that will be printed will be meat for him. There will doubtless

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be certain passages in every lesson which a master here and there would like to have elaborated. Every master must feel free to express his wish for more detailed information. It will be fully given by Mr. Long upon request. The course of instruction can be made far more efficient by the active participation of the masters in it through a question and answer department. They are invited to make the columns of the MARINE REVIEW a correspondence school at the MARINE REVIEW'S expense. No matter how much research the question may require, it will be carefully gone into and answered through the columns of the REVIEW. Every master who asks a question must understand that in obtaining enlightenment for himself, he is also bestowing it upon every other master.

FREIGHT SITUATION.

Since navigation opened an unusual number of accidents have taken place in the rivers owing to the low stage of water. During the past two years vessel owners have been favored with high water, but this year opens with an unusually low stage of water. Nearly all the strandings that have occurred so far are directly attributable to the fact that the water is less than was supposed. For the present vessels had better not load deeper than 18 ft. 6 in. for the Lime kilns.

Every effort is being made to rush ore to Lake Erie docks though the physical obstacles to overcome are great. Ore is not moving freely to upper lake docks and as even contract vessels have to wait for cargoes there is absolutely no demand as yet for wild tonnage. As the season, however, opened a few days earlier this year than last, it is expected that ore shipments will now be greater for April than they were last year. What is being received is doing directly aboard cars and efforts are being made to clear Lake Erie docks of ore, so that by May 1 it is expected that they will be fairly bare. The lake fleet in its initial movement took considerable coal to upper lake ports, but since that time it has not been coming freely forward so that shippers are having no difficulty in getting all of the coal tonnage they want at present.

Regarding labor conditions, it must be admitted that things are looking somewhat squally, but everyone hopes that an amicable adjustment may be perfected. Labor would not gain anything by a cessation of work at present as furnaces are pretty well supplied with raw material. The present contract between the dock managers and the Longshoremen's Association at Lake Erie ports expires on May 1. No date has been set for a renewal of this contract since the termination of the recent conference. The present agreement provides that the men shall work eleven hours a day. One of the demands at the recent conference was that ten hours should constitute a day's work and during the present week the men have been working only ten hours and will work only ten hours from now on until May 1. It will be remembered that the conference between the Longshoremen and the dock managers was terminated because the Longshoremen demanded, as a condition of further negotiation, that the Lake Carriers' Association recognize the mates' union. As the dock managers have absolutely nothing to do with the Lake Carriers' Association they could not make that a condition of the settlement. The longshoremen thereupon withdrew and the matter stands as it was left at that time. The only union with which the executive committee of the Lake Carriers' Association has yet to deal is that of the firemen and grain scoopers. They will probably meet next week. Labor on the great lakes is paid better than it is in any other part of the world and it will be a pity if the traffic of the great lakes is interrupted through trifling, unnecessary or unreasonable demands.

RUSSIAN NAVAL CONSTRUCTION.

Details are published by the *Neue Freie Presse* of the construction program which was sanctioned recently for the Russian navy by the Czar, and which is to be spread over a term of nine years. The program comprises 12 battleships, 15 cruisers, 46 torpedo-boat destroyers, 18 torpedo-boats, 10 submarines, 7 gun-boats, 9 monitors, and 1 mining ship—a total of 118 vessels. The distribution of the navy thus to be created is as follows:—For the Baltic Sea Fleet:—Nine turret-ships, each of 16,000 to 17,000 tons displacement, with four heavy, fourteen medium, and fifty-six quick-firing guns, armored with nickel steel, 230 millimeters (9 in.) thick, and with a speed of 18.5 knots; four first-class cruisers of 12,000 tons, having a complete belt and protection to the central battery of 135 millimetres (5¼ in.) thick, and carrying forty quick-firing guns—a novel armament owing to the absence of heavy guns; eighteen deep-sea torpedo-boats of 250 to 300 tons, a mining ship of the Yenissei type, and ten submarines. For the Black Sea fleet:—Three squadron armored ships of 12,500 tons, to replace the old-fashioned turret-ships Sinope, Ekaterina II., and Tchesma, which date from 1886 and 1887, to be armed and protected in the same way as the other modern armored vessels of the Black Sea fleet, with four guns of 30.5 centimeters (12 in.), four of 20 centimeters (7¾ in.), twelve of 15 centimeters (6 in.), thirty-two small-bore quick-fires, and with 229-millimeter (9 in.) armor, and a maximum speed of 16 knots; seven first-class cruisers of 12,750 tons; four second-class cruisers of the Kagul and Otchakoff type, hitherto denominated first-class, each of 6,700 tons displacement, and a speed of from 22 to 24 knots; and 28 torpedo-boat destroyers of the Zwonki type, of 350 tons, and a speed of 26 knots. For the Far East:—Six coast gun-boats, of 800 to 1,000 tons, armed with one heavy, two medium, and twelve light guns, and a speed of 14 knots; and nine shallow-draught gun-boats, of 250 tons, for the rivers of northern Siberia. For the Persian Gulf:—One stationary gun-boat. Cost:—The total cost is calculated at 380,000,000 roubles (£38,000,000), to be divided into nine installments, to be added each year to the 117,000,000 roubles (£11,700,000), required annually for the normal expenses of the navy. The total naval budget for the next nine years will therefore be 159.2 million roubles (£15,920,000), in which sum is included the cost of equipping and constructing arsenals and docks.

The new yard for building iron ships and the new floating dock at Frederikshaven, on the northern part of the east coast of Jutland, will be ready to commence work in the course of the present summer. The floating dock will be capable of receiving ships up to 3,000 tons, and the ship yard will be able to build vessels and lighters of 1,000 tons. The name of the company is the Frederikshaven Floating Dock and Shipyard.

The Upper Delaware River Navigation Co., owners of the steamboats Columbia, Twilight, Bristol and Burlington, has been sold to New York parties. Capt. Daniel David Van Cleff, general manager of the Montauk Steamship Co., has assumed charge of the line.

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APPOINTMENTS OF MASTERS AND ENGINEERS.

GOODRICH TRANSPORTATION CO., CHICAGO, ILL.

Vessel.	Captain.	Engineer.
Str. Christopher Columbus	Chas. E. Moody	G. McLaughlin
Str. Virginia	E. E. Redner	G. P. Roth
Str. Carolina	C. McCauley	Dolph Zeitsch
Str. Indiana	E. Taylor	C. H. Bon
Str. City of Racine	J. A. Wilson	J. Peroutka
Str. Iowa	E. Dorsey	J. Buschman
Str. Georgia	A. Johnson	G. Suckow
Str. Sheboygan	C. Baldwin	A. Galbraith
Str. Chicago	————	T. Dorey
Tug Arctic	B. Sniffin	G. Germanson

THOMAS BRADWELL, 128 CLARK ST., CHICAGO, ILL.

Tug Leslie	Geo. McDonald	
Schr. J. B. Wilbor	James Wilton	
Schr. A. Bradley	C. Chapman	

CHICAGO-SOUTH HAVEN LINE, CHICAGO, ILL.

Str. Eastland	F. A. Dority	Wm. Nack
Str. City of South Haven	J. M. Mitchell	M. Madden
Str. City of Kalamazoo	Frank Swailes	J. Q. Adams
Str Petoskey	M. O'Connor	Fred Linesmyer

DESERONTO NAVIGATION CO., DESERONTO, ONT.

Str. Resolute	John Gowan	John Harrison
Str. Reliance	Jas. Dougherty	John Toppings
Str. Ella Ross	D. B. Christie	M. J. McFaul
Str. Jessie Bain	M. Palmateer	M. Toppings
Str. Rescue	Thomas Lynch	Owen Flood
Str. Armenia	Albert Barnhart	John Jamieson
Str. Ranger	Howard Burnip	John McFaul
Str. Arctic	W. J. Daly	Wm. Turner
Schr. Recruit	Dan. McFicar	

W. J. PULLING, WINDSOR, ONT.

Str. Juno	Archie McInnis	A. Kerby
Schr. Sligo	J. McPherson	————

JERRY MCCARTHY, 159 OHIO ST., BUFFALO, N. Y.

Schr. Iron City	John Bartley
Schr. Grace Holland	M. Nagle

Gilbert McPhail will be the engineer for the steamer Charles Beattie of the Wilson Transit Co.'s fleet for the season of 1906.

BOUTELL STEEL BARGE CO., BAY CITY, MICH.

Str. Bay City	C. D. Brown	Leonard Sleno
Str. Bay Port	K. A. Jensen	Neil Marshall
Str. Bay View	Mr. Cummings	Emerson Harner
Str. Bay State	Mr. Pederson	Mr. Curtis
Bge. Baroness	D. McFadyen	
Bge. Bombay	C. Philps	
Bge. Baravia	A. Siljander	
Bge. Badger	C. Gabrielson	
Bge. Brittania	W. Wilson	
Bge. Berkshire	A. Trodo	
Bge. Baden	————	

WESTERN TRANSIT CO., BUFFALO, N. Y. E. T. DOUGLAS, MNGR.

Str. Boston	H. L. Dennis	Wm. Tibby
Str. Buffalo	John Fisher	James Sangers
Str. Chicago	Thomas Slattery	John W. Rainey
Str. Commodore	M. Folan	John Metke
Str. Duluth	S. R. Jones	F. A. Miller
Str. Milwaukee	F. D. Osborn	Daniel Donohue
Str. Mohawk	Henry Murphy	Chas. L. Murray
Str. Superior	Donald Gillies	John W. Mark
Str. Syracuse	John Kennedy	Albert Scott
Str. Troy	Robert Murray	F. W. Hall
Str. Utica	John Davis	Patrick Welch
Bge. Ben Brink	Alex. Ruske	
Bge. Grey Oak	Rodman Almy	

JAMES DAVIDSON, BAY CITY, MICH.

Str. Rappahannock	Chas. Ainsworth	E. W. Tilley
Str. Sacramento	Hugh Stevenson	A. G. Olmsted
Str. Shenandoah	Geo. W. Starkey	Peter Mullen
Str. Orinoco	Jas. T. Cannally	Jos. D. Gonyou
Str. Amazonas	E. Smades	S. G. Cowell
Str. Venezuela	E. J. Starkey	Roy Hansen
Str. Cartagena	F. H. Danger	George A. Miller
Str. Bermuda	A. W. Henderson	James Wellman
Str. Panama	Warren C. Jones	W. J. Downing
Schr. Montezuma	W. H Hargrove	
Schr. Montanzas	Charles Smart	
Schr. Chieftain	Martin Johnson	
Schr. Granada	————	
Schr. Paisley	Alex. McCormick	
Schr. Grampian	Charles Fourinea	

ARTHUR C. HELM, MNGR. ESTATE W. M. EGAN, DECEASED, CHICAGO, ILL.

Str. Philip D. Armour	F. D. Chamberlin	Frank Keating
Str. John Plankinton	Geo. F. Stilphen	C. Bendschneider
Str. Wiley M. Egan	————	C. H. Diem
Str. R. P. Fitzgerald	E. B. Marquette	T. Carlson

WHITE STAR LINE, DETROIT, MICH. B. W. PARKER, GEN. MNGR.

Str. Tashmoo	Burt S. Baker	Winfield Dubois
Str. Greyhound	Mr. Meikelham	David Maxwell
Str. City of Toledo	J. J. Stover	M. J. Gilligan
Str. Owana	Harry Tyrie	C. H. McCarten

ADOLPH GREEN, GREEN BAY, WIS.

Str. George Burnham	Edward Carns	C. D. Elliott
Bge. S. C. Baldwin	Frank Morris	

BLACK DIAMOND TRANSIT CO., DETROIT, MICH.

F. W. MINER, SUPT.

Str. Saginaw	D. M. Fisher	Wm. McMartin
Schr. Wm. Case	F. McDermaid	

KELLEY LUMBER & SHINGLE CO., TRAVERSE CITY, MICH.

Str. Emma E. Thompson	H. Bennett	Frank Kimber
Schr. Anna P. Grover	H. Erickson	

C. F. BIELMAN, DETROIT, MICH.

Str. Florence B.	John Ivers	Joseph Rousseau
Str. Florence B.	Harry C. Beattie	Wm. Gerardo

NIAGARA RIVER DAY LINE., TORONTO, CAN.

Str. Chippewa	W. H. Solmes	H. Parker
Str. Corona	Robert Clapp	A. J. Woodward
Str. Chicora	C. J. Smith	W. A. Black
Str. Ongiara	H. J. McIntyre	Robert Marshall
Str. Cayuga	John McGiffen	Geo. M. Arnold

VOLUNTEER TRANSIT CO., CLEVELAND, O.

Str. Charles Beatty	Hugh McKenzie	Chas. J. Snyder

JOHN P. BOLAND, BUFFALO, N. Y.

Str. Yale	M. S. Peterson	George Haig
Str. John M. Nicol	James Saunders	Frank Herringer
Str. Eber Ward	A. B. Slyfield	Ed. Snell
Str. Alcona	J. H. Warnick	E. Hull
Str. Winnipeg	Charles Clarke	Adam Haig
Str. John Pridgeon, Jr.	John O'Hagan	M. Mallon
Bge. S. J. Tilden	Thos. Hefferman	

GREEN BAY VESSEL CO., GREEN BAY, WIS.

Str. Orion	G. H. Scott	H. McElhinney

The Mississippi River Commission has just completed a tour of inspection on the levees of the government steamer Mississippi. This commission is composed of General O. H. Ernst, president; Lieut. Col. Clinton B. Sears, of New Orleans; Major Henry B. Richardson, of New Orleans; Major T. L. Casey, of St. Louis; Judge R. S. Taylor, of Fort Wayne, Ind.; Mr. John A. Ockersen, of St. Louis; Mr. Homer R. Ritter, U. S. Coast & Geodetic Survey, and Capt. W. B. Ladue, secretary of the commission. The steamer left St. Louis on April 4 and reached New Orleans on April 13. The commission reports that the levee line while far from complete is in very good condition and able to withstand any rise in the river that is likely to occur this year.

Walter S. Lloyd and John H. Wright, of Duluth, have bought the steamer Mascotte from the Delray & Belle Isle Ferry Co., of Detroit. The Mascotte is an iron ship 103 ft. long, 29 ft. beam and 8 ft. deep.

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OPENING OF NAVIGATION AT MACKINAC.

Following is the record of the opening of navigation and the first passage through the straits of Mackinac for the past sixty-nine years:

Year.	Date.	Vessel.
1837	May 28	Str. James Madison.
1838	April 26	Str. Pennsylvania.
1839	April 30	Str. Columbus.
1840	April 11	Str. Chesapeake.
1841	April 25	Str. Great Western.
1842	March 26	Str. Chesapeake.
1843	May 8	Str. Bunker Hill.
1844	April 10	Str. Missouri.
1845	April 5	Str. Hercules.
1846	April 10	Str. Bunker Hill.
1847	April 29	Str. Louisiana.
1848	April 13	Str. Manhattan.
1849	April 12	Schr. Petrel.
1850	April 4	Schr. Republic.
1851	April 4	Schr. Republic.
1852	May 9	Str. Wisconsin.
1853	April 18	Str. Forest City.
1854	April 25	Brig Globe.
1855	May 2	Schr. Republic.
1856	May 2	Schr. David Todd.
1857	May 1	Str. Lady Elgin.
1858	April 6	Schr. Fred Hill.
1859	April 2	Str. City of Cleveland.
1860	April 13	Str. Prairie State.
1861	April 25	Str. Nile and Free State.
1862	April 18	Str. Queen of the Lakes.
1863	April 20	Str. Badger State.
1864	April 23	Str. Bristol.
1865	April 21	Str. Montgomery.
1866	April 29	Str. Montgomery.
1867	April 23	Str. Montgomery.
1868	April 20	Str. Montgomery.
1869	April 27	Str. Dominion.
1870	April 17	Str. City of New York and City of Concord.
1871	April 2	Str. City of Fremont.
1872	May 2	Str. East.
1873	May 1	
1874	April 29	
1875	April 28	
1876	April 28	
1877	April 20	
1878	March 14	
1879	April 23	
1880	April 5	
1881	May 4	
1882	April 5	
1883	April 28	
1884	April 28	
1885	May 6	
1886	April 21	
1887	April 23	
1888	May 4	
1889	April 15	
1890	April 20	
1891	April 17	
1892	April 18	
1893	April 29	
1894	April 17	
1895	April 25	
1896	April 18	
1897	April 22	
1898	April 11	
1899	May 2	
1900	April 19	
1901	April 26	
1902	April 2	
1903	April 9	
1904	May 1	
1905	April 18	
1906	April 11	

TOLEDO FUEL CO.

The Toledo Fuel Co. has secured the fueling docks heretofore operated by the Stanley B. Smith Coal & Dock Co., which has retired from business in Toledo. A. M. Donovan is president and general manager of the Toledo Fuel Co., Mr. Donovan has been general manager of the Stanley B. Smith Coal & Dock Co. since its organization, and previous to that time he was for eight years associated with Stanley B. Smith & Co., Detroit, Mich, operators of Smith's coal dock, River Rouge. The docks are located on the Hocking Valley Ry., Toledo & Ohio Central Railway and Pennsylvania Lines. They are equipped with ample modern coal handling machinery, and the new company will carry ample supplies of the best grades of West Virginia and Ohio coals. In addition to the docks mentioned the company will operate the fuel lighter Kanawha which carries 500 tons of coal in 5-ton buckets.

PERSONAL.

On account of the rapid expansion of the business of the Westinghouse Machine Co., the board of directors has decided to enlarge the executive organization by increasing the number of vice presidents from two to four, and has elected Mr. E. H. Sniffin and Mr. Arthur West to fill the new offices of third and fourth vice presidents respectively. Mr. Sniffin will be in charge of the sales department as heretofore, his field of work not being altered in assuming the new title. Mr. West, who has been chief engineer of the company, still retains that title and position. Mr. Wm. A. Bole, in consequence of his election to the vice presidency of the Westinghouse Foundry Co., has resigned his position as manager of works of the Westinghouse Machine Co. in order that he may better serve the interests of the foundry company, of which he assumes the entire management. The Westinghouse Machine Co., however, retains Mr. Bole as consulting engineer, availing itself of his services and counsel on important work, which his ripe experience has made peculiarly valuable. Mr. Henry L. Barton, formerly general superintendent of the East Pittsburg works of the Westinghouse Machine Co., has been appointed manager of works.

Mr. L. F. Bower, formerly manager of the electrical works of the Allis-Chalmers Co., in Cincinnati, who was recently promoted to the position of comptroller of the company, has already assumed the duties of his new office, with headquarters at the general offices of the company, Milwaukee. Mr. Bower was born and spent the early years of his life in Berwick, Pa. He attended Wesleyan University, Middletown, Conn., from which he graduated in 1879. For five years following graduation, he held a position in the treasurer's office of the Jackson & Woodin Mfg. Co., Berwick, Pa., where he became intimately associated with the persons now in control of the American Car & Foundry Co. Mr. Bower then spent three years in Carlisle, Pa., as principal of the preparatory department of Dickinson College. For one year thereafter he was managing partner of Bower & Mallery, chain manufacturers in Carlisle, Pa. Having sold out his interests to the Standard Chain Co., he was for two years superintendent of the car department of Allison Mfg. Co., in Philadelphia, which concern he left on the death of Mr. Allison. For six years Mr. Bower was manager and treasurer of the Carlisle Mfg. Co. in charge of all departments. They manufactured freight cars, frogs and switches, and vertical steam engines. From 1896 to 1901, Mr. Bower was secretary and treasurer of the Dickson Mfg. Co., of Scranton, Pa., manufacturer of locomotives and all kinds of heavy machinery. When the machinery department of this concern was absorbed by the Allis-Chalmers Co. in 1901, Mr. Bower was retained as manager of the Scranton plant until 1904. On April 1, 1904, he went to Cincinnati as secretary and treasurer of the Allis-Chalmers Co.'s electrical department, and in 1905 he was appointed manager. While at Scranton, Mr. Bower studied law and was admitted to the bar of Lackawanna county.

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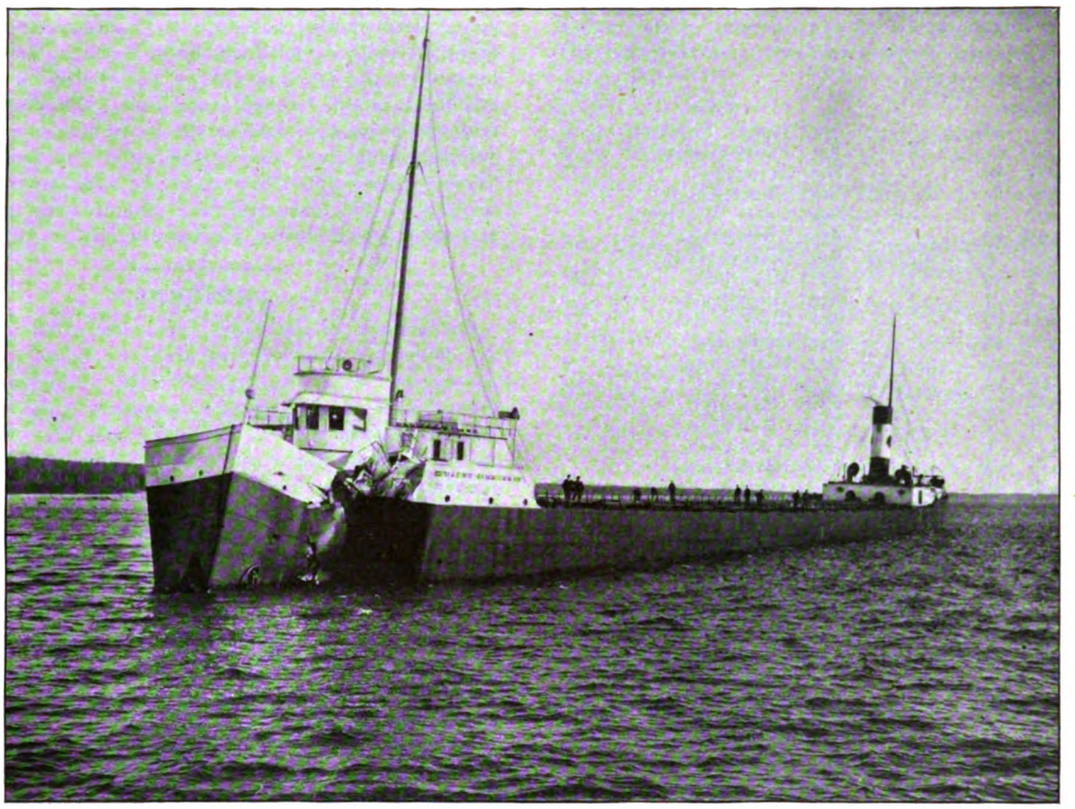


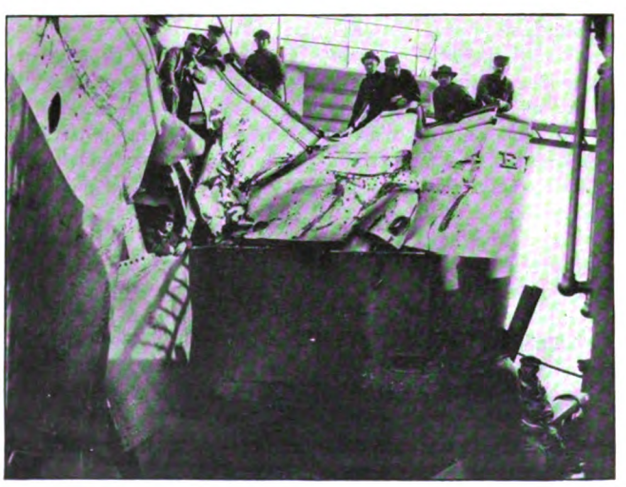
THE EUGENE ZIMMERMAN, AS SHE APPEARED AFTER HER COLLISION WITH THE SAXONA.

AROUND THE GREAT LAKES

The new steamer Frank C. Ball carried 9,716 tons of coal on her maiden trip up the lakes.

After lightering 200 tons of ore, the steamer Malietoa was released apparently uninjured.

The steamer building at the yard of the Polson Iron Works, Toronto, for the Toronto Ferry Co., was launched last week.



DETAIL PHOTOGRAPH OF THE ZIMMERMAN'S INJURIES.

Work has been started at Grand Haven on the construction of a wooden tug for the United States Engineers' Department.

The barge John Smeaton was released from the Lime Kilns by the steamer Ericsson and the tugs Frank W. and Home Rule after 1,000 tons of her cargo had been lightered.

The Cuyahoga river above the Superior street viaduct, Cleveland, is badly in need of dredging, there being only 16 ft. of water.

The steamer J. T. Hutchinson, down bound with grain, struck at the Dyke this week. She was temporarily repaired at Detroit.

Wm. Wharry, wheelsman on the steamer Kensington, was taken from his steamer and is very ill with typhoid fever in the hospital at Port Huron.

The barge Manila which was flung on the beach near Two Harbors in the great November storm, will go into dry dock for repairs within a few days.

The whaleback barges Bombay and Baroness, bound up with coal in tow of the steamer Bay City ran aground last week on the east bank of Lime Kiln crossing.

The freighter Fred C. Mercur was the first to deliver a cargo of iron ore at Tonawanda this year. She took 1,243 gross tons to the plant of the Tonawanda Iron & Steel Co.

Capt. Arthur H. Hawgood has been appointed manager of the Hawgood Transit Co. and the Wisconsin Transit Co. to succeed his brother, the late Henry A. Hawgood.

The steamer Ellwood and barge Constitution held ore cargoes at the head of Lake Superior all winter and the ore was so badly frozen that dynamite had to be used to get it out.

The passenger steamer Frontenac, which last year ran between Lorain and Cleveland has been chartered to run out of Chicago this summer. She will be in command of Capt. A. F. Pitman.

The steamer Saxona, which collided with the steamer Eugene Zimmerman in St. Mary's river, reached Buffalo safely and discharged her valuable cargo of flax, which was fortunately uninjured.

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President Livingstone, of the Lake Carriers' Association has closed contract with the Hackett Wrecking Co. and Duff & Gatfield to maintain floating aids to navigation in lower Detroit river again this year.

The schooner W. O. Goodman, for many years in the Chicago Lumber trade, has been sold by Mrs. Eliz T. Johnson to W. B. Price, of Boston, and will be taken to the Atlantic to engage in the coastwise trade.

Capt. Arthur Clark, of the tug Pilot, was blown to pieces by an explosion of an acetylene gas buoy in the ship channel about ten miles from Parry sound this week. The buoy was being charged with gas from the tug at the time.

The steam yacht Wayward owned by A. A. and B. W. Parker, of Detroit, has been sold to Capt. E. J. Dodge, of Sandusky, for $2,800. He will make her a flush deck boat and operate her in the passenger business about Put-in-bay.

Capt. Neil Campbell, master of the steamer H. C. Frick, was stricken with pneumonia while en route to the lower lakes and was placed in the hospital at Cleveland. The steamer was brought to Lake Erie by Capt. Frank D. Root, of the Great Lakes Towing Co.

Major James L. Leisk, corps of engineers, has been ordered to Detroit to relieve Col. G. J. Lydecker, of the lake survey work of which he has had temporary charge since Major W. L. Fisk was relieved, owing to ill health. Major Fisk has been transferred to the Philippines.

All grain unloading records were broken at the Mutual elevator at Buffalo when 321,637 bu. of grain were taken out of the steamer Hoover & Mason in less than thirteen hours. This is the first grain cargo that the Hoover & Mason has carried. Low water at Fort William made it impossible for her to take on a full cargo.

In connection with the operation of the draw span of the Houghton-Hancock bridge across Portage Lake, masters are directed by Major Charles L. Potter, government engineer, to use only the south draw at the opening until further notice, owing to the fact that the north draw is obstructed by shoals and some old bridge material.

A deal has been closed by which Harriet Hart, executive of H. W. Hart, deceased, sells the entire interest in the Green Bay Transportation Co. to L. C. Schilling. The case of Harriet Hart recently brought against Schilling and the transportation company in which a receiver was asked for and an injunction requested, was dismissed.

A decision has been handed down by Judge Hazel in the United States court of Buffalo, sustaining the finding of a jury in the case of James Pettingill, who sued the owner of the steamer John Owen for personal damages received by transferring ice from a small supply boat to the steamer. The jury awarded a verdict of $4,520 to Pettingill with costs.

The steamer City of Erie was compelled to put back in Cleveland port on Tuesday evening within twenty minutes after having left the harbor, owing to a trifling derangement of machinery. A nut on the high-pressure cylinder had become loosened, and the steamer put back into port to have it tightened, there being no wrench on board of sufficient magnitude to tighten the nut.

The steam schooner building at the ship yard of W. A. Boole & Son, San Francisco, for Beddle Bros., of San Francisco, will be named Sybil Marston. This new vessel will be 215 ft. long, 44 ft. beam and 16 ft. 6 in. deep.

The directors of Cammell-Laird & Co., Ltd., Birkenhead, have declared an annual dividend of 10 per cent on the ordinary shares and 5 per cent on the preferred.

HAMBURG-AMERICAN STEAMSHIP CO.

This large concern keeps pushing ahead with unceasing energy, extending and expanding in all directions, and it now boasts a fleet, all told, of 349 vessels (of which 157 are ocean steamers), with an aggregate gross tonnage of 811,943 registered tons. Last year was the company's fifty-ninth year, but it is only during the last twenty years or less that it has become one of the leading steamship companies. Its aggregate tonnage in 1886 only amounted to some 65,000 tons, and as late as 1899 the tonnage was not half so big as at present. The Hamburg-American Steamship Co. has also managed exceedingly well during the last year or two, which have been unprofitable to many shipping people. This will appear from the following table:—

	1903. Marks.	1904. Marks.	1905. Marks.
Surplus	22,009,274	29,504,331	37,769,784
Less interest on debentures	1,702,500	1,674,609	1,626,797
	20,306,774	27,829,722	36,142,987
Writings off and added to funds....	13,832,524	17,959,886	24,009,428
	6,474,250	9,869,836	12,133,559
Dividends	6,000,000	9,000,000	11,000,000
Carried forward ..	474,250	869,836	1,133,559

The earnings during the last three years in consequence amount to 22 per cent, 29½ per cent, and 37¾ per cent of the share capital (which amounts to 100,000,000 marks, or £5,000,000), and the dividends have consequently been 6, 9, and 11 per cent respectively. The fleet of ocean steamers is booked at 156,000,000 marks, and the average age of the fleet, according to tonnage, is only seven years six months. The reserve and the renewal funds have 13,000,000 marks to their credit, and the reserve insurance fund over 14,000,000 marks. According to the report, the excellent results for last year are principally due to the profits on the Hamburg-New York trade. The trade with the east is also stated to be satisfactory, as well as the future prospects for this branch.

CAPTAINS SUFFER HEAVY FINES.

The law of 1882 in regard to overcrowding of immigrant quarters in passenger ships is being rigidly enforced in San Francisco as well as in all over the United States. In compliance with instructions from the department of commerce and labor, Collector Stratton, of the port of San Francisco, has caused inspections to be made of vessels sailing from that port. The result has been that a large number of fines have been imposed, some of them for considerable amounts.

A report of the work done was forwarded to the department of commerce and labor, and Secretary Metcalf has approved of the fines. Action to collect these fines will be taken at once, and delay or failure to pay them will be followed by civil prosecution by the United States district attorney.

These fines are on account of overcrowding, of inadequate dining facilities, and of non-separation of the sexes.

The penalties imposed, the names of the captains and vessels, and the dates of their arrivals are as follows: Capt. Porter, Mongolia, Jan. 26, $2,250; Capt. Green, Nippon Maru, Jan. 9, $1.550; Capt. Friele, China, Jan. 31, $1,560; Capt. Hayward, Ventura, Feb. 28, $540; Capt. Smith, Doric, Feb. 14, $1,620; Capt. Reimers, Meira, Feb. 21, $20; Capt. Lawless, Mariposa, Jan. 26, $30; Capt. Trask, Acapulcu, Feb. 14, $1,340; Capt. Saunders, Manchuria, Feb. 21, $220; Capt. Robinson, City of Pekin, Jan. 21, $955.

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DRY DOCK AT GALVESTON NEEDED.

The harbor of Galveston is very much in need of a capacious dry dock and ship repairing plant. It has become a port of much importance during the past few years, not alone for coastwise service but for foreign trade as well but there are no competent facilities for repairing the fleet that visits it. At present a number of government dredges are lying in the harbor with broken shafts and other injuries awaiting repairs. Referring to this condition of affairs Mr. T. J. Anderson, a student of shipping and one of the representatives of the underwriters said:

"While Galveston stands in the front rank of the ports of the United States and is the leading port on the Gulf in the matter of volume and value of its foreign business, besides having an immense and valuable coastwise business, the port ranks so low in the matter of equipment for repairing injured vessels that the underwriters are constantly inquiring of me as to what is being done and what is going to be done in the near future to remedy the matter. Not only from an insurance standpoint should the port of Galveston have dry dock or floating dock facilities, but from a business standpoint. According to the January edition of the *News* there entered this port during the year 1905 372 vessels in the foreign trade and 438 vessels in the coastwise trade, aggregating 1,767,387 tons, and of a property value of many millions of dollars. Many of these vessels are in the Cuban and Mexican trade the year round, and others during the summer months, and every one has had to go to New Orleans or Mobile for hauling out for cleaning or repair work. With the proper equipment at this port the work would have been done here, and in addition there are many other vessels that would have been sent to this port for docking purposes.

"According to Lloyds register the port of New Orleans has six docks. The government dock will lift 18,000 tons, and besides this dock there is one which will lift 5,000 tons, another 1,200 tons and another 1,000 tons, two of the six docks being used mainly for the purpose of repairing river boats and other small craft.

"Pensacola has three docks, lifting 2,000 tons, 1,000 tons and 300 tons respectively, while Mobile has one lifting 3,500 tons, another 3,000 tons and another 1,000 tons, besides three marine railways for smaller vessels. All of these docks are kept busy the greater part of the year and oftentimes vessels are kept waiting several days to be lifted. Galveston has one marine railway capable of lifting 1,000 tons, a very good railway for its size, but totally inadequate for a port of this size and importance.

"If the port of Galveston is going to continue to enjoy the distinction of being one of the great ports of the world, some one will have to get busy, and provide the equipment necessary to repair injured vessels. It is of the utmost importance to the port that either a dry dock or a floating dock of a capacity to lift the average vessel in this trade be provided and the quicker it is done the quicker the underwriters will put the stamp of approval opposite the name of this port on their account books."

VALENCIA INQUIRY.

Error in judgment on the part of Capt. Johnson, commander of the vessel, but such as probably any other master would have made under the circumstances are the central causes of the wreck of the ill-fated steamship Valencia, which met disaster the night of Jan. 22, entailing the loss of the lives of 133 of the 168 passengers aboard, according to the findings of the United States marine inspection board whose decision is now in the hands of the government. The investigation conducted by Capt. Bion B. Whitney and Robert A. Turner, constituting the board, was concluded and a copy sent to the secretary of commerce and labor, the United States inspector-general and Capt. Bermingham, supervising inspector, two weeks ago.

The decision does not censure Capt. Johnson, but by inference it sets forth that it was his mistake that sent the vessel to her doom. These were in miscalculating the current which ran continuously up the coast and with such velocity that he overran his course and piled the vessel on the treacherous Vancouver reefs. It is found also that the Valencia in her northward run stood off shore so far that she did not get into the unusually deep water just off Cape Flattery and thus have her position revealed by the results of the continuous soundings customary in such weather.

The Valencia's equipment, the board finds, was in first class condition—all that the law required, and more. She had a competent crew. Some of the men, it is pointed out, may have been new to the vessel, but they were followers of the sea, trained in their duties. It is held that the evidence showed that Capt. Johnson ordered the lifeboats lowered to the saloon deck rail.

Reference is made to the fact that no fire drill was held and that while the law does not contemplate a drill more frequently than once a week, it would have been better to have had such a practice on this voyage.

The decision does not deal specifically with the Queen and City of Topeka or those in charge of the rescue ships. No one is censured in this connection. As to the Queen's going away, it is pointed out that she left a well-equipped and smaller vessel—one able to get in closer to the scene of the wreck—in charge of the rescue work.

NEW FRENCH LINER LA PROVENCE.

The new French line steamer La Provence left Havre last week on her maiden trip to New York. The new liner is the largest ship in the French mercantile marine. She measures over 627 ft. from stem to stern, is of 14,200 tons, and her normal speed is of 21 knots, permitting the trip across the Atlantic to be made in six days. Accommodation is provided for 400 first class passengers, 200 second, and 900 third. The crew consists of 500 men, under the command of fourteen officers. In addition, there is a staff of 150 waiters, stewards, stewardesses, etc., making a total of 2,000 persons on board when all her cabins are filled.

The main saloon of La Provence is in Louis XVI style, in white and gold, and lighted by a large dome. The dining saloon seats 250, and is decorated in Louis XV style. Besides these there are smoking rooms and boudoirs, which together with the staterooms are all furnished in the most artistic and comfortable manner. There are six suites de luxe, each provided with special bathroom and electric heating apparatus. An elevator has been installed to convey passengers to and from the three upper decks.

An interesting feature of the new steamer is the elaborate system of precautions for the safety of passengers. All the lifeboats, numbering twenty, together with six rafts, can it is claimed, be put into the water in forty seconds by means of an ingenious apparatus requiring only four men to work it. Each cabin, besides, is provided with lifebelts. Against the danger of fire a network of indicators connects every part of the ship with the bridge and the engine room. The officer of the watch can close every watertight compartment from his post. Finally, La Provence is fitted with wireless telegraphy apparatus.

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ITEMS OF GENERAL INTEREST.

The Newport News Ship Building & Dry Dock Co. will overhaul the American liner St. Paul.

The Ocean Steamship Co., of Savannah, has given contract to Roach's Ship Yard, Chester, Pa., for a steamer to be a duplicate of the one now under construction at that yard for the company.

The Spokane Machinery & Supply Co., Spokane, Wash., has completed the engines for the new steamer to be operated on Coeur d'Alene lake by Captains A. Vacklund and Pigrass. The hull of the steamer is being built by P. W. Johnstone, Spokane, Wash.

Mr. Walter H. Metcalf, the well known marine diver and contractor of Cleveland, is equipping one of the most complete boats for his line of work on the lakes. A compressed air plant is being installed and the large derrick will be equipped with an exceptionally heavy clam-shell bucket furnished by the G. H. Williams Co. of Cleveland.

The G. H. Williams Co., of Cleveland, recently received an order from the Hoyt & Patterson Co., Incorporated, at Pittsburg, for three 3-yard clam-shell buckets for use in coal. The company has also delivered a 2-yard bucket to the Grover & Stephens Co., of Cleveland, and has six or eight more now building. The bucket is meeting with much favor.

The Portland Co., Portland, Me., has just received the hull of a large dredge built for the Breyman Bros. Co., of Toledo, for their own use in Boston harbor in connection with government contracts. The Portland Co. will install machinery and boilers complete in the dredge at their works when she will be sent to Boston and placed in commission.

Herr Ballin addressing the shareholders of the Hamburg-American Steamship Co., said the results of the two Cunard turbine steamers had to be considered before the Hamburg-American line would approach the question of applying the turbine to their new ocean steamers. All authorities, he said, agreed that the turbine should only be used when the usual engine could not be relied upon to produce a very great speed. He did not believe that the turbine would supplant the reciprocating engine.

The Canadian government has placed an order with Vickers, Sons & Maxim, of Barrow, to build an ice breaker steamer with the object of keeping the River St. Lawrence clear of ice in the winter season. From the experience with a similar steamer in the Baltic, it is believed a good navigable channel can be maintained as far as Montreal, and if this proves to be the fact, it will be of immense importance to Canada, and will probably lead to the construction of a fleet of ice breakers.

The Pacific Coast Steamship Co.'s big liner, City of Pueblo, which became disabled at sea some months ago, and was towed to San Francisco, will be ready to resume service again May 5. She will be commanded by Captain Jepsen, her old master—a veteran in the coastwise service. Since being laid up the City of Pueblo has been completely overhauled. Twelve new staterooms were added. A new tail shaft and a low-pressure engine were also installed. The work was done at the Union Iron Works.

Meetings will be held at Kansas City, St. Louis and Chicago, on May 14, 15 and 16 respectively, which will be attended by Representative Ransdell, of Louisiana, chairman of the executive committee of the National Rivers and Harbors Congress; Representative Ellis, of Missouri, vice president of the National Rivers and Harbors Congress; and Representative Lorimer, of Chicago, who is at the head of the proposed deep waterway project between Chicago and St. Louis. The purpose of the meetings is to crystallize sentiment in favor of the improvement of waterways.

The new Ward liner Merida, the largest steamship ever built for the American coastwise trade, sailed on her maiden trip to Havana last Saturday afternoon. The Merida is in command of Capt. Frank Stevens, the commodore of the Ward line, and left port with a full complement of passengers. The new vessel is 416 ft. long, 50 ft. beam, 30 ft. depth, and registers 8,000 tons. She is equipped with the De Forest system of wireless telegraphy, and the company announces that a newspaper containing all the latest news will be published on board every day she is at sea.

The Great Lakes Coal Co.'s mines are located at Kaylor in the northeast portion of Armstrong county, Pa., about forty miles north of Pittsburg. The company owns a standard gauge railroad eighteen miles in length, known as the Western Allegheny, connecting at Queen Junction with the Pittsburg, Bessemer & Lake Erie railroad. It is intended to extend the branch road to Newcastle. Practically the entire production of the mine is shipped at present over the Pittsburg, Bessemer & Lake Erie to connecting lines and points on the great lakes. The company owns 25,000 acres of land, the greater portion of which is underlaid with coal.

The risk and dangers of those engaged in submarine boats is sought to be lessened by an invention of Mr. Thomas Doyle, of Leacombe, Liverpool, who, being a diver and salvage expert of long experience, knows the ropes, and is well able to suggest practical improvements. The enhanced feeling of confidence given to the officers and men who undertake the handling of submarine boats must of necessity have a beneficial effect, and even should there be no danger, in some cases this ingenious invention will, it is said, prove a great saving, because it enables the submerged vessel to be raised. The British admiralty authorities have the invention under consideration, and mention will probably be made of it in parliament very shortly.

The Marine Safety Appliances Co., of Cleveland, has succeeded the Irvine-Lihou Co. as manufacturers of the Irvine-Lihou lifeboat handler, a recently invented mechanical device for swinging out and lowering lifeboats on board vessels. The officers of the new company are: Mr. T. F. Newman, of the Cleveland & Buffalo line, president; Mr. F. B. Dalzell, of New York, first vice president; Mr. D. C. McIntyre, of the Detroit & Cleveland line, second vice president; and Mr. Gustav Vonden Steinen, secretary and treasurer. This boat handler, patents of which were issued on May 9, 1905, has already attracted the attention of government officials and marine authorities. Unusual appreciation has been accorded to it considering the brief length of time that it has been on the market.

On March 28 there was launched from the Wallsend ship yard of Swan, Hunter & Wigham Richardson, Ltd., a steel screw steamer which has been built to the order of the Donald Steamship Co., and which is intended to run in the fruit service of the United Fruit Co. between the West Indies and United States ports. The leading dimensions of the vessel are: Length over all, 237 ft.; beam, 31 ft. 8 in. and depth, molded, 16 ft. The engines have been constructed by the North Eastern Marine Engineering Co., of Wallsend, and consist of a set of triple expansion engines, having cylinders of 21, 34 and 56-in. diameter, by 36-in. stroke, steam being supplied by two single-ended boilers, working at a pressure of 180 lbs. This machinery is expected to drive the vessel at a speed of about 12½ knots in regular service. On leaving the ways the vessel was named Bella by Mrs. James Donald, of Glasgow.

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WHY A YOUNG MAN SHOULD ENLIST IN THE NAVY.

ADMIRAL DEWEY IN POPULAR MECHANICS.

It gives me much pleasure to comply with your request for my views on this subject. It is very near my heart, for it is upon the young men of the country that we must depend for the defense of our country's honor on the sea, and when the advantages of enlistment are better known, there should be no lack of applicants for positions in our naval service. The naval career offers many advantages to a young man; but primarily he should have a taste for the sea, and then, in order to rise, in this career as in all others, he must apply himself diligently to acquiring all the details of a life full of interesting features. The navy needs active, intelligent young men, and to those who will devote themselves to learning their profession every encouragement is held out. Enlisting at seventeen years of age the recruit at once becomes self-supporting; he is supplied with a complete outfit of clothing, and from that time until he dies, provided he remains in the service of the government, he is cared for in sickness or in health; and after thirty years of service if he is still an enlisted man, or upon reaching the age of sixty-two if he holds a commission he may retire and receive for the remainder of his life three-fourths of the sea pay to which he was entitled at the time of his retirement.

The pay at first may seem small, when compared with what a brother may receive in civil life; but the young man should remember that in addition to his pay the government provides him with quarters and food, and that the naval life gives him an opportunity of visiting various parts of the world. This last consideration alone must counterbalance much that comes to a man in civil life, for there is nothing which broadens and educates as does travel.

In August last Lieut. Henry B. Soule, United States navy, who entered the service as an enlisted man, wrote a letter which is so much in the line of this subject, "Why a Young Man Should Enlist in the Navy," that I quote the following:

"My personal experience has been that no man who shows the least desire to learn and improve himself in the naval service will ever lack assistance from officers or enlisted men of longer experience. No concern on shore offers more for the intelligence invested than does the navy to the average American boy. As the law stands today, a boy can enter the service at 17 years, reach warrant rank with a salary of from $1,200 to $1,800 a year by the time he is 24 or 25 years of age, secure a commission in the line three years later, and enjoy the rank of full lieutenant at the age of 30. From then on his promotion is just as rapid and he will just as surely reach the grade of rear-admiral as any other officer of similar rank. Should a young man lack the ambition or education to reach one of these higher grades (commissioned rank) he can still win out against his brother in civil life if he sticks to the service. During the thirty years an enlisted man is required to serve before retirement, his pay will average $40 per month. He ought to save $30 of that if he is as careful of his earnings as he would have to be in civil life, and should have $9,000 in the bank, not counting interest, when he is ready to retire at the age of 47, with $40 a month for the remainder of his life. Can you beat that in the factory, in the store, or on the railroad?

"But a young man should not be discouraged because he fails to obtain an officer's commission, nor must he expect to win this prize unless he devotes himself honestly to the work of preparation. The examinations are severe and rightly so; for the young man who pursues a course at the naval academy has to work hard all of the time in order to obtain his commission, so it is but just that the young man whom we are considering should also have to work for it. A last consideration which I trust will appeal to every American, is the patriotic desire of every young man to serve his country. The deeds of naval officers have added many brilliant names to our country's roll of honor; and when a young man enters the navy he may feel that it is quite possible his own name may some time be added to the list."

MERCHANT MARINE LEAGUE.

Mr. George J. Seabury published in the New York *Journal of Commerce* the following excellent communication on the shipping bill:

"Sir:—It is a great pity that the shipping bill should be imperiled through legislative disagreements or jealousies between the house and the senate. An American merchant marine is today the greatest need of our industrialists, agriculturists and ship builders; apart from the fact that constructive statesmanship should have years ago forced the enactment of this great arm of commerce. Not alone is it a national enterprise that has never received protection, but it is a diffusive, non-sectionial prosperity promoter! Oversea ship building will in a few years take a place in the front rank of our prominent industries.

"We shall be embarrassed in shipping our exports and imports more than ever, since last year our volume of trade increased over the previous year's record more than $200,000,000. Our national commerce for 1906 will reach $3,000,000,000. We carry in American-built ships less than 5 per cent of this great commence—a most humiliating fact!

From current reports, foreign shipping lines are chartering additional vessels to carry American freights. In the event of a foreign war, annually menaced, we would lose millions of dollars per annum on account of not being able to deliver promptly our exports or to forward imports; this latter disability would cripple our home commerce by not being able to secure raw materials. It is a serious problem to contemplate in either dilemma, and yet we can fairly lay the foundations of a merchant marine by commencing to build steamships and vessels in 1906.

"It is a purely national economic necessity either for the protection of our established commerce and developing the forces that will be of incalculable service to our navy, or for war emergencies. Our commerce, however, has the greatest claim for the prompt enactment of a liberal subsidy act.

"I hope that Speaker Cannon will waive his prejudices and listen to the patriotic demands and needs of the nation to relieve the situation by our becoming independent. There is not a single sound argument for defeating the senate shipping bill that is worthy of consideration. The creation of oversea ships on even a broader plan than adopted by the senate will be immensely profitable to American interests, its labor-field, manufactures, raw materials and capital, in permanently establishing this great protective industry. There is no risk in the measure. The enterprise cannot be unsuccessful, since it is an absolute necessity.

"Foreign influences are being exerted in every direction; their representatives in and out of congress are influential, resourceful and desperate, and their funds are unlimited. There is in the mere shipping profits alone for carrying our immense and increasing exports and imports more than $35,000,000 per annum, so you must believe the statement that if money will defeat an American shipping bill, as it has in the past, foreign influence will again dictate our national shipping policy. Let us believe in the triumph of patriotism, and that the house will enact even a broader subsidy act than passed by the senate.

The Northwestern Steamship Co., Seattle, Wash., through John Rosene, its president, has purchased from the Ward Line of New York, the steamers Orizaba, Saratoga and Yucatan. They will be placed on the Alaska run.

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PROGRESS MADE IN THE APPLICATION OF THE PARSONS TURBINE TO MARINE PROPULSION.

BY R. J. WALKER, M. I. N. A.

Before proceeding to deal with the subject of this paper, it may be of interest to some of the members of this society to give a brief history of the development of the turbine as an engine now extensively used for the purpose of generating electricity.

In 1884 the first compound steam turbine engine was built by the Hon. C. A. Parsons, and was applied to the driving of a dynamo. This engine was designed for 10 horsepower, with a modified high-speed dynamo, and for a working speed of 18,000 revolutions per minute. It ran for some years doing useful work, and is now in South Kensington museum.

Subsequently, efforts were made towards the construction of engines of larger sizes, which resulted, in the year 1888, in several turbo-alternators of 120 horsepower being supplied for the generation of current in electric light stations, and at that period the total horsepower of turbines at work reached in the aggregate about 4,000, all of which were of the parallel-flow type and non-condensing.

In 1892 the steam turbine was first adapted to work in conjunction with a condenser. This engine was capable of developing 200 horsepower at a speed of revolutions of 4,800 per minute, and drove an alternator of 150 kilowatt output. In view of the proposal to use steam turbines for the lighting of Cambridge, this engine was tested by Professor Ewing, F. R. S. The result of the test showed a consumption of steam of 27 lbs. per k. w. hour, which is equivalent to about 16 lbs. per I. H. P., with steam moderately superheated and a vacuum of 28 inches.

Since then, Mr. Parsons has made various improvements, until at the present time the steam turbine is generally recognized by engineers to be an efficient and practical engine, which, in the larger sizes, has attained a high degree of economy in steam.

The following table shows the advance made in sizes and increased economy in steam consumption:

Date	Capacity	Steam per Kilowatt Hour	Vacuum	Superheat	Steam Pressure per square inch
	Kilowatts	Lbs.	Inches	Degrees F	Lbs.
1887	55	50	[illegible]	[illegible]	120
1892	100	27 00	27	50	-
1898	1,250	18 81	[illegible]	180	130
1901	1,000	17 30	[illegible]	198	150
1902	3,000	14 74	27	235	158
1904	4,000	15 40	28.7	150	200

Superheating of the steam has been adopted in the case of land turbines, and it has been found by experiments that for every 10 degrees F. of superheat, the steam consumption is reduced by about one per cent.

Turbine engines are also used for generating electrical current for the transmission of power, the working of electrical tramways, railways, electric pumping, coaling, and similar purposes. They are also used for coupling direct to, and driving fans for, producing forced and induced draft for general ventilating purposes; also for driving centrifugal and screw pumps, and also for the more important work of driving blowers for supplying air under pressure for blast furnaces and other purposes.

The total horsepower of turbines of the Parsons' type delivered and on order, including turbines at work and under construction of licensees on the continent and in the United States at the present time for land purposes, is about 1,500,000 horsepower. The installations now on order, include units of upwards of 10,000 horsepower.

*Read before the Liverpool Engineering Society.

Almost from the time that the first success was achieved by the steam turbine, Mr. Parsons had in view the possibility of the application of the turbine to the propulsion of ships.

In 1894 a company was formed to investigate the application of the steam turbine to marine propulsion, which company ultimately led to the formation of the Parsons Marine Steam Turbine Company, Ltd., of Turbinia Works, Wallsend-on-Tyne.

The principal business of the pioneer company was to construct a vessel of a practical size in which the application of the steam turbine to the propulsion of vessels could be satisfactorily demonstrated, and here a difficulty arose. In all new inventions, it is natural to begin with small sizes; with turbines, however, it would have been advantageous to have commenced with larger sizes. It is a well-known fact that turbines of large size and power are more economical than turbines of small powers, but on the score of financial economy it was somewhat out of the question to commence experimenting with large sizes. After careful consideration of the best type of boat to advantageously try the experiment, the Turbinia was constructed with a view of obtaining a high rate of speed, her dimensions being 100 feet in length by 9 feet wide, and a displacement of 44 tons.

Between the years 1894 and 1896, many experiments were made with the Turbinia, necessitating radical changes in the design and arrangement of the machinery. The first engine which was tried was of the radial flow type, giving about 1,500 horsepower to a single screw. The results, however, were far from satisfactory, a speed of only 18 knots being obtained. Several different propellers were tested with this engine, and the results compared with the power registered by a dynamometer showed in every case a very low propeller efficiency. The original turbine engine was removed, and the engines finally adopted, consisted of three turbines in series—high pressure, intermediate pressure, and low pressure—each driving a separate shaft, with three propellers on each shaft. A reversing turbine was coupled with the low pressure turbine to the central shaft. Very exhaustive trials were carried out by Professor Ewing in 1897, and were the subject of a paper read by Mr. Parsons, which paper is to be found in the *Transactions of the Naval Architects* for the year 1903.

The results of the Turbinia clearly demonstrated the possibilities of the turbine when applied to the propulsion of vessels. One of the chief difficulties, however, which Mr. Parsons had to contend with in applying the steam turbine to the propulsion of ships, arose in connection with the propellers. For reasons of economy in steam, and size of turbines, it is necessary for turbines to run at a high rate of speed, which necessitates the introduction of some modification of conditions in regard to the propellers, as compared with propellers driven by ordinary reciprocating engines at slower speeds of revolutions. When very high rates of revolutions are adopted, cavities are formed at the back of the propeller blades, owing to the water not being able to follow around the blades fast enough, which detracts largely from the efficiency. Mr. Sydney Barnaby, some time previous to this, investigated the screw propeller, and found that in torpedo-boat vessels, propelled by fast-running reciprocating engines, the limit at which cavitation commenced was very nearly reached, if, in some cases, not actually passed. In the early trials of the Turbinia, Mr. Parsons had to deal with this difficulty in a very much greater degree, and he made some very interesting and instructive experiments with model screws, with a view of throwing some light upon the question of cavitation. Model screws were made to revolve with great rapidity in a small air and water-tight tank, all the air being removed from the surface of the water by means

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of an air pump. The propeller was illuminated in a definite position of each revolution, and to the eye it appeared stationary. At a speed of revolutions corresponding to the Turbinia's original propeller, the experiments showed that there was considerable loss in the propeller efficiency, due to cavitation.

Following the success of the Turbinia, the torpedo-boat destroyers Viper and Cobra were built and fitted with turbine machinery for the royal navy, and achieved remarkable speeds, the Viper taking the position of being the fastest vessel in the world, having attained the phenomenal speed of 36.86 knots per hour. Unfortunately, however, the Viper ran on the rocks of the Channel islands in a fog, and ultimately became a total wreck. The Cobra foundered in a storm. Thus, after two or three years of hard work, the Turbinia was the only vessel afloat fitted with turbine engines.

The Parsons Marine Steam Turbine company had directed their almost exclusive attention to the introduction of the turbine in destroyers, as being the most favorable among vessels for the application of the turbine system, but, unfortunately, owing to a report prevalent at the time, that the consumption at cruising speeds was much greater than that of ordinary engines, and by the total loss of the only two sets of machinery fitted at that period, with the exception of the Turbinia, it had a very detrimental effect upon the introduction of turbine machinery generally. About this period, very great difficulty was experienced in endeavoring to induce railway companies, and owners of mercantile vessels, to build a turbine vessel; each company appeared to be very anxious that someone else should make the first experiment. Those closely associated with the development of the turbine were beginning to somewhat despair of success when Captain John Williamson came forward, and the result of a conference between Messrs. W. Denny & Bros., of Dumbarton, Captain Williamson, and Mr. Parsons, was that it was resolved to build a turbine vessel for passenger service on the Clyde.

It was in the year 1901 that the King Edward, the first turbine vessel for the mercantile marine, was built. So successful was this vessel during the first season's running on the Clyde (the year of the great exhibition at Glasgow), that an order was placed for a second vessel, Queen Alexandra, and the performance of these two vessels running on the Firth of Clyde, demonstrated the commercial advantages accruing from the adoption of the turbine system. Captain Williamson's name will long be associated as the pioneer ship owner adopting the turbine system for the mercantile marine.

Since the King Edward and Queen Alexandra were put on service, they have run every season with remarkable success, and the machinery has not given the slightest trouble.

The performance of these two vessels, and of two other similar vessels on the Clyde, fitted with reciprocating machinery, is given, by the courtesy of Captain Williamson in these tables:—

	Length Feet	Bre'dth Feet	Draft Feet	Displacement Tons	Trial Speed Knots	Average Working Speed	No. of Passengers Vessel certified to carry
Turbine Steamer—King Edward	250	30	6	650	20½	18½	1,994
Turbine Steamer—Queen Alexandra	270	32	7	750	21¼	19	2,077
Paddle Steamer—Duchess of Hamilton	250	30	5.6	638	18	16	1,780
Paddle Steamer—Juno	245	29	6.25	632	19¼	17½	1,497

Season 1901	Mileage Miles	Mileage per Day Miles	Sailing Days	Mileage per Ton Miles	Average Coal per Day Tons
King Edward	12,116	153.5	79	8.47	18.1
Duchess of Hamilton	15,504	140	111	8.87	15.85
Juno	9,777	115	85	7.07	16.25
Season 1902					
King Edward	15,605	142	110	8.24	17.25
Queen Alexandra	16,598	156.5	106	8.14	19.2
Duchess of Hamilton	14,850	141.5	105	8.51	16.6
Juno	10,150	122.25	83	7.84	15.6
Season 1903					
King Edward	18,435	174	106	8.45	20.6
Queen Alexandra	19,421	155.5	125	8.11	19.15
Juno	9,845	114	86	6.71	17.0
Season 1904					
King Edward	19,253	182	106	8.23	22.0
Queen Alexandra	19,978	162.5	123	7.44	21.82
Duchess of Hamilton	13,028	153	85	8.90	17.25
Juno	10,497	116.5	90	6.85	17.0
Season 1905					
King Edward	20,906	172	122	8.9	19.25
Queen Alexandra	18,439	164.5	112	9.0	18.25
Juno	11,310	123	92	7.73	16.0

Further interesting figures as to the coal consumption of the King Edward were made public by Captain John Williamson. He stated that a steamer of a similar type, and practically of the same dimensions and the same service speed, but fitted with ordinary engines, steamed 12,106 knots in 80 days on a coal consumption of 1,909 tons, at an average speed of 18½ knots. As against this the King Edward steamed 12,116 knots in 79 days, on a coal consumption of 1,429 tons, at an average speed of 18½ knots. Thus the turbine vessel steamed 10 knots more in all, at the same speed, on a coal consumption of 480 tons less.

Other vessels very quickly followed the King Edward and Queen Alexandra.

The first vessel to be fitted with turbines for cross-channel service was The Queen, for the Southeastern and Chatham Railway Co.'s Dover and Calais route. This vessel confirmed the economical results obtained in the King Edward and Queen Alexandra, and when compared with other vessels on the same route fitted with reciprocating engines, the earning power of The Queen has been found to be very much greater. Perhaps no clearer proof is required of this than that the owners have recently added two new turbine steamers to their fleet for cross-channel service—Onward and Invicta.

The following table shows the earning power of the turbine-propelled channel steamer, The Queen, on the Dover-Calais route, as compared with three other vessels fitted with ordinary engines on the same route. The table shows the percentage, difference of coal, oil, and engine-room staff, per passenger each vessel is certified to carry, taking The Queen as a standard on which the figures are based.

The figures from which the following table has been formulated were supplied by Captain Dixon, marine superintendent of the South-Eastern and Chatham Railways.

At or about the same time as The Queen was ordered, the London, Brighton, and South-Coast Railway Co. placed an order for a channel steamer for their Newhaven-Dieppe service, viz.:—Brighton, and they last year added a second turbine vessel—Dieppe—to their cross-channel service.

	Dimensions	Service Speed	Per Passenger Vessels certified to carry		
			Coal Burnt	Oil used	No. of E.R. Staff
	Feet	Knots	Percentage Increase	Percentage Increase	Percentage Increase
The Queen	323 by 43	21	—	—	—
B	324 by 34.9	18	74	197	103
C	280 by 35	18½	25	147	46.7
D	313 by 36	17½	107	169	73

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	Per Passenger Vessels certified to carry		No. of Trips made in Six Months
	Cost of Coal, Oil, and E. R. Staff	Passengers per Ton Coal Burnt	
	Percentage Increase	Percentage Less	Percentage less
The Queen	—	—	—
B	80.5	42.5	80.8
C	33.6	20	29.7
D	106	53	7.8

Other interesting comparisons are furnished by the results of the four steamers designed by Professor Biles for the Midland Railway Co. and which formed the subject of a paper read by Professor Biles' partner, Mr. Gray, before the Institution of Naval Architects last year.

One of the latest channel steamers to be fitted with turbine machinery is the Viking. She was built and engined on the Tyne for the Isle of Man Steam Packet Co., for their Liverpool to Douglas service. This vessel achieved the mean speed of 23.53 knots on her official trial from Souter Point to Flamboro' Head and back. An abstract from the log of this vessel on her first season's running, last year, shows that during the months of June and July she made 31 trips between Liverpool and Douglas, and her average speed was 22.22 knots. In the month of July she made 15 trips between Douglas and Fleetwood at an average speed of 22.67 knots, and between Douglas and Dublin 3 trips, average speed 22.39 knots.

By the courtesy of the Isle of Man Steam Packet Co., results are given in the following table of the coal consumption, mileage, average speed, etc., of Viking, as compared with three other vessels on the same service.

	Viking	B	C	D
Length	350 feet	350 feet	330 feet	265 feet
Breadth	42 "	42 "	39 "	34 "
Draught	11 "	13 "	10 ft. 6 in.	10 ft. 6 in.
Displacement Tons	2400	2,940	—	1,520
Gross Tonnage	1990	2,140	1,657	937
No. of Passengers certified to carry—No. 2 Limited Board of Trade	1950	1,994	1,546	901
Total Mileage per Season Knots	8880	7,870	9,577	12,072
Coal per Season Tons	4206	4,833	4,206	3,883
Average Speed of Service Knots per hour	22.2	20	19	17
No. of Engineers, including Greasers, but excluding Boiler Room complement.	4 Engineers 3 Greasers	5 Engineers 5 Greasers 1 Fanman	4 Engineers 2 Greasers —	3 Engineers 3 Greasers —
Type of Machinery	Turbines	3 Cylinder Compound Paddle	2 Cylinder Compound Paddle	Twin-Screw Triple-Expansion
Tons of Coal per Knot	472	.614	.439	.317

Five yachts have now been fitted with Parson's marine turbines, viz., the Emerald, to the order of Sir Christopher Furness, M. P.; the Lorena, for A. L. Barber, Esq.; the Tarantula, for the late Colonel M'Calmont; the Narcissus, for E. M. Mundy, Esq., and the Albion, for Sir George Newnes.

The two latest yachts fitted with the Parsons turbines are the Narcissus, built and engined by the Fairfield Ship Building Company, and the Albion, designed by Sir W. H. White, built by Messrs. Swan, Hunter & Wigham Richardson, and engined by the Parsons Marine Steam Turbine Company. The propelling machinery of both of these yachts, it is understood, has given every satisfaction since they were handed over to their respective owners.

In yachts where a great deal of cruising is required below one-third to one-half power, cruising turbines could be fitted, if required, to assist the economy at the lower speeds.

The Allan Line Steamship Co. were the first to introduce the turbine system to vessels of large size and moderate speed for Atlantic work, and the two vessels fitted, viz., the Victorian and the Virginian, gave very satisfactory results on trial trip on a reduced draft. It is understood they have done very good work whilst on service on the Liverpool-Canadian route during the season 1905, and have become very popular with passengers. The best mean speed over the passage between the two points of call has reached 17.2 knots per hour with an estimated I. H. P. of 12,600, and the coal consumption worked out about 1½ pounds per estimated I. H. P. for all purposes.

As regards war vessels, the destroyers Velox and Eden were the next vessels following on the Viper to be built for the British admiralty. These two vessels were fitted with additional engines for obtaining economical results when cruising at low speeds. The Velox was fitted with two small auxiliary reciprocating engines, whereas the Eden was fitted with two cruising turbines. When cruising at low speeds, the steam from the boiler passes through the two cruising engines in the case of the Velox, and the two turbines in series in the case of the Eden, and thence to the main turbines and condensers. An efficient expansion of the steam is thus secured from the boiler to the condenser pressure.

The latest vessel to be fitted with turbines for the British admiralty was H. M. third-class cruiser Amethyst. This vessel is also fitted with cruising turbines, and the results of the trials give the comparative performances of the turbine machinery as compared with sister vessels ordered at the same time as the Amethyst, and of the same dimensions and lines, but fitted with reciprocating engines. The trials of these ships unmistakably demonstrated the economy of the Parsons marine turbine as fitted in this class of vessel, and more especially at the higher powers.

One of the greatest steps in the application of the turbine to marine propulsion was, undoubtedly, when the Cunard Steamship Co., after thorough investigation into the technical details and capabilities of the turbine by a committee of leading engineering experts, decided to adopt turbine machinery for their two new express liners, designed to be the largest, fastest, and most powerful vessels afloat.

The author well remembers when Mr. Parsons, in one of the earlier papers, delivered before one of the leading technical association, previous to the King Edward being tried, suggested that the proposal to fit Atlantic liners with turbines of 20,000 to 30,000 I. H. P. presented no great difficulties. The majority of engineers, who were imbued with the idea that what Mr. Parsons was attempting was impossible, were rather startled, and yet, within the period of four years since the first mercantile vessel was built, the turbines for the express Cunarders are under construction, each of them more than double the horsepower mentioned by Mr. Parsons in the paper referred to.

At the same time as it was arranged to fit the two express Cunarders with Parsons' turbines, it was decided to fit one of the two intermediate Cunard liners, viz., the Carmania, then on order with Messrs. John Brown & Co., Clydebank, with turbines, thus forming a direct comparison with the sister vessel, the Caronia, fitted with reciprocating engines, and the results of the trials, which have appeared in *Engineering* and other leading papers, showed that the Carmania obtained a mean speed of 20.2 knots per hour, which was estimated to be about one knot faster than the Caronia under similar conditions, and on service the coal consumption on her first voyage has been reported to compare favorably with the very satisfactory performance of the Caronia in this respect.

It may be of interest, at this stage, to mention a few points incidental to the application of the turbine system to different classes of vessels. It is desirable, for obvious reasons, that a turbine for a given efficiency should be

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designed to run at as high a rate of revolutions as possible, consistent with propeller efficiency. The speed of turbines for land purposes is considerably higher than is permissible for turbines for marine purposes where the speed of rotation is limited by considerations of propeller efficiency. As already referred to, the great difficulty which Mr. Parsons had to contend with arose in connection with the number of propellers to adopt to obtain the best compromise of turbine and propeller efficiency. In the Turbinia, and in several of the earlier vessels, a considerable number of experiments were carried out with various designs of propellers. With the original engine that was tried in the Turbinia, nine propellers in all were tested, with the same unsatisfactory result. After the original turbine was removed and replaced by the existing three turbines, further propeller experiments were carried out. The first set tried consisted of three propellers on each shaft—nine in all—of 18 inches diameter and 18 inches pitch, which gave favorable results. Subsequently other sets were tried, and the set eventually adopted comprised three propellers on each shaft—nine in all—of 18 inches diameter and 24 inches pitch, so that dividing the power over the three shafts, a considerable increase in efficiency was obtained, and a speed of 32 knots was reached. In May, of 1902, further experiments were made with single propellers on each shaft. Progressive runs were first made with the nine propellers, when it was found that the speed relative to water consumption followed exactly the same curve as that obtained by Professor Ewing previously. The first set of single propellers tried were 28 inches diameter and 28 inches pitch, and the second set were of the same diameter, but with a pitch ratio of 0.8.

The loss of efficiency which has been observed in some of the earlier vessels which were fitted with multiple propellers appears to have been due partly to the interference from the forward screws and partly to cavitation.

With a view to increasing the revolutions the diameters of propellers and pitch ratios are less than is usual in the case of ordinary reciprocating engines, the smaller diameter of propeller necessitating higher ratios of blade surface to disc area than hitherto attempted with ordinary propellers.

Although more light might yet be thrown on the question of high-speed propeller efficiency, a considerable amount of experience has now been obtained with turbine-driven propellers, which enables a close estimate to be made as to the efficiency which might be expected in a given design where reliable data as to horsepower necessary for the proposal in question can be obtained.

There is no doubt that for certain classes of vessels the turbine has a distinct advantage over the reciprocating engine, and the larger the power of the machinery, and the higher the speed of the vessel, the more favorable is the comparison with turbines as regards economy. There is, however, at the present time, a lower limit of speed of vessel below which this advantage gradually disappears, and this speed would appear to be, generally speaking, about 15 knots, with a corresponding horsepower of about 1,600. With higher power (say) 5,000 to 6,000, then probably a lower speed of (say) 14 knots might compare favorably with reciprocating engines.

For lower speeds of vessels, to obtain reasonable propeller efficiency, a certain diameter of propeller is necessary, and the revolutions to correspond are moderately low, and as it is necessary to obtain a certain surface speed of turbine, as well as a certain number of rows of turbine blades, to obtain reasonable economy, the size of the turbine becomes great in proportion to the power, the efficiency being somewhat impaired thereby; moreover, the weight and cost is increased, as compared with turbine machinery of similar powers for higher speeds of vessel.

As regards the question of turbines for ordinary cargo tramps, the author would like to refer to the presidential address by Mr. Parsons to the Institute of Marine Engineers, wherein he outlined the probable development of the turbine in the future for marine work as follows:—

"With the evidence at present before us, I think we are safe in predicting that it will soon supersede entirely the reciprocating engine in vessels of 16 knots sea speed and upwards and of over 5,000 I. H. P., and probably also including vessels of speeds down to 13 knots of 20,000 tons and upwards, and possibly to still slower vessels in course of time. At the present, it may, I think, be said that the above most suitable field comprises about one-fifth of the total steam tonnage of the world; but it must be remembered that the speed of the ships tends to increase and the turbine to improve, and so the class of ships suitable for the turbine will increase.

"It seems probable also that a combination of the reciprocating engine and the turbine will be found the best machinery for vessels of the tramp class in the immediate future. This field is a very large and important one, and deserves more attention than it has yet received, and I should like to explain to you the position more clearly, for I am sure it is worthy of your most earnest consideration.

"The case may be put thus:—In a slow vessel (say) of 10 knots speed, the revolutions must be low, because a certain disc area of propeller and a certain number of square feet of blade area are necessary in order to avoid too great a slip ratio and consequent loss of propeller efficiency. It is also proved by experiment that the pitch ratio cannot be reduced much below .8 without commencing to incur excessive loss from skin friction of the blades, so we have no alternative but to accept the highest revolutions possible under the circumstances, which, in a 10-knot vessel, is a low figure.

"To obtain a reasonable economy from a turbine, a certain surface speed of the turbine blades is essential as well as a certain number of rows of blades. If the revolutions are low, the diameter and also the number of rows must be increased in order to maintain the economy. The result is that for 10 knots the diameter and number of rows become inordinately great, the weight and cost become excessive, and also, added to this, the efficiency of the turbine is somewhat impaired by such extravagant dimensions in proportion to the power realized. We are, therefore, blocked on three lines, and must choose some other course.

"Fortunately, there is a way out of the difficulty by which we can obtain the full measure of expansion essential to economy, a superior economy to the best set of tramp engines in existence.

"Fortunately, it is possible to make a turbine to deal economically with very low-pressure steam, and to expand this low-pressure steam, thereby fully and economically, and yet with a turbine of moderate cost and of slow revolutions.

"If we examine the indicator cards of a tramp, we find that the steam is usefully expanded down to about 7 lbs. pressure absolute, and that it is then released into the condenser, and the remaining energy between 7 lbs. down to (say) 1½ lbs. or 27 in. vacuum is almost entirely lost. Now, what the turbine can do is to save (say) 70 per cent of this wasted power, and apply it to help to drive the vessel.

"The additional power gained by the use of this low-pressure turbine has been calculated to be between 15 per cent and 20 per cent of the whole now realized, a gain of

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the same order as was obtained in the advance from the compound to the triple engine. This is the main feature of the case; minor points, of course, there are, such as improvements of the condenser (as a good vacuum is very essential to all turbines for the best results) and also feed-heaters fed from the exhaust of auxiliaries or low-pressure steam drawn from the main engines for heating the colder feed due to the higher vacuum."

In regard to the arrangement of turbines, this partly depends upon the condition of service, and the various classes of vessels require, more or less, to be taken upon their own merits. The arrangement which has been almost universally adopted in the mercantile marine is that of dividing the power equally over three shafts, viz., a high pressure on the center shaft exhausting into two low-pressure turbines one on each side of the vessel. No doubt the members of this institution are more or less conversant with the principle of the Parsons turbine. Each turbine consists of a number of rings of blades or vanes mounted on a drum or rotor. This rotor is enclosed within a cylindrical case, upon which rings of blades are also fitted. The rings of blades are alternately fixed and moving, that is to say, the blades of the cylinder are stationary or guide blades, whilst the blades fitted on the drum are moving blades. The diameter of the drum is less than the cylindrical case, and thus an annulus is left between the two, which is occupied by the blades referred to. Steam issuing from the boilers flows through the first row of fixed or guide blades on the cylinder, it then, in jets of moderate velocity, impinges on the moving blades, and imparts to them a rotary motion, this process being repeated on each successive ring of fixed and moving blades throughout the turbine.

The areas of the steam passages through the blades gradually increase from one end of the turbine to the other, to correspond with the expansion in volume of the steam for the range of pressures from beginning to the end of the turbine.

In the exhaust casing of each of the low-pressure turbines, a reversing turbine is fitted.

By means of suitable valves, when maneuvering, the low pressure and astern on each side of the vessel, are capable of being worked ahead or astern, as required, independently of the high-pressure turbine (the high-pressure turbine under such conditions running idly in a vacuum). By this arrangement, the vessel has all the maneuvering qualities of a twin-screw vessel.

In torpedo boats, a similar arrangement is adopted as in the Turbinia, viz.:—Three in series, with one astern on the center shaft only. This arrangement permits of a reduced weight being obtained, as compared with the high pressure and two low pressure in parallel for equal efficiency.

In very large powers, it is desirable to divide the power over four shafts, thereby increasing the revolutions and reducing the size of the units. The four-shaft arrangement lends itself well to large war vessels, as two complete sets of engines are obtained, viz.:—one high pressure and one low pressure, with condensing plant in each engine room.

A two-shaft arrangement of machinery was adopted in the yacht Narcissus, which, as previously described, gave very good results; but for powers over about 2,500 to 3,000, a two-shaft arrangement entails additional weight.

On account of the greater range of expansion dealt with in the turbine, as compared with the reciprocating engines, a good vacuum is much more essential in the former than in the latter, and because of the importance of a high vacuum with the steam turbine, careful consideration requires to be given to the condensing plant.

With a view of maintaining a high vacuum, Mr. Parsons has designed a new apparatus, to assist the ordinary air pump and condenser, termed "Vacuum Augmentor." The augmentor consists of a small steam jet placed in the contracted portion of a pipe, led from the bottom of the condenser. The jet draws air from the condenser, and delivers it to the air pump through a small auxiliary cooler. By this means the air is reduced to a negligible quantity, and the vacuum in condensers can be higher than in the air pump, thus increasing the efficiency of the machinery.

The vacuum augmentor has now been fitted in several vessels, with very good results.

Very careful experiments were made on 1,500-k. w. turbo alternator with and without vacuum augmentor, and an extract from the data shows the following result, at about two-thirds of the normal output:—

WITHOUT VACUUM AUGMENTOR.

Steam pressure pounds per square inch	Load K.W.	Speed of Revolutions per minute	Vacum at Condensers	Pounds of Water per hour	Pounds of Water per K.W.
115	1,030	1,500	25.32	21,264	20.7

WITH VACUUM AUGMENTOR.

111.6	1,060	1,500	27.4	19,830	18.66

In the Virginian and Manxman, the rise in vacuum due to the augmentor was 1¼ to 1½ in., representing an additional economy of about 7 per cent to 8 per cent.

The steam used by the jet is about 1½ per cent, leaving a net gain of about 6 per cent. The effect of an increase in vacuum of 1 in. at 26 in. has been found to decrease the consumption by about 4 per cent, and for 1 in. at 28 in., about 6 per cent. By later refinements the steam used by the jet is under 1 per cent.

Another point which has been greatly discussed in connection with turbine machinery is the question of boiler pressure. The effect of difference of boiler pressure between 150 lbs. to 200 lbs. is relatively smaller with turbines than with reciprocating engines, and it is very questionable, in the majority of cases, whether the saving in coal by the adoption of high boiler pressure would justify the increase. More especially is this the case in moderate speed vessels, where the turbines are somewhat larger for the power as compared with higher speed vessels. In such cases, the turbines could be designed to have their full measure of economy with boiler pressure not exceeding 150 lbs.

The question of astern power was very freely criticized in the earlier vessels fitted with turbine machinery, due perhaps to the fact that the proportion of power provided for astern was somewhat on the small side. In more recent vessels, a larger proportion of power has been provided, as circumstances demanded, and very good maneuvering qualities have thereby been obtained.

Other advantages incidental to the turbine might be cited, such as reduced weight of machinery, steadiness and smoothness of running, reduction in oil and stores, and absence of racing in a seaway, and other advantages which have brought the turbine to a commercial success.

So rapid has been the development of the marine turbine, that the Turbinia company have found it necessary to make arrangements with other builders to manufacture turbines.

There are, at the present time, about 25 of the leading ship building and engineering firms in this country, in addition to foreign licensees, who have acquired the license to build Parsons turbine engines.

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TRADE NOTES.

The Globe Boiler Works, Toledo, O., has removed to their new building, corner of Water and Jackson avenue, where they have most commodious quarters.

The New York & New Jersey Lubricant Co., 14-16 Church street, New York, are putting out an interesting little booklet entitled "The Survival of the Fittest Lubrication." Those interested in economical operation of machinery would do well to write for this booklet.

The Independent Pneumatic Tool Co., First National Bank building, Chicago, has just issued Circular No. 6, descriptive of Thor pneumatic tools. The company says that its business has marvelously increased during the past year, and that its tools are finding their way into all markets.

The Stamford Foundry Co., Stamford, Conn., will equip the four new freight steamers building by the Fore River Ship Building Co. for the Atlantic & Birmingham Construction Co. with Shipmate ranges. This range is really a very popular one on board ship.

The Harbison-Walker Refractories Co., Farmers' Bank bldg., Pittsburg, Pa., have issued a little booklet on brick for boiler settings which is intended for free distribution. It is a very valuable little talk to superintendents and engineers who are responsible for the care of boilers. Many reasons are advanced why the brick manufactured by this company is the best.

The Fort Wayne Electric Works, Fort Wayne, Ind., have just put out two bulletins, one devoted to small direct current generators and the other to multiphase reversing field belted generators. Instruction book No. 3023 on type K multiphase integrating wattmeters has also been put out. These publications will be sent to anyone interested upon request.

The Greenwood-Atkinson-Armstrong Co., Detroit, Mich., are distributing an attractive blotter containing a reproduction of Valenkamph's painting "Homeward Bound" and incidentally advertising their yachting uniforms.

The Niles-Bement-Pond Co., 111 Broadway, New York, in its April issue of the *Progress Reporter* describes the machine shops of the Bethlehem Steel Co., South Bethlehem, Pa. These shops have a world-wide reputation on account of their heavy class of work and its up-to-date shop matters. The selection of machine tool equipment has been especially careful and the many years of experience has enabled the company to try out all classes of machine tools and to find those best suited to the requirements of their work, namely, great accuracy and large output. The company feels that the great preponderance of Niles-Bement-Pond and Pratt & Whitney machines in these shops is one of the best advertisements it could have. This issue of the *Progress Reporter* is illustrated with a number of splendid photographs of the machine shops of the Bethlehem Steel Co.

"Spring Painting" is the title of the latest publication issued by the Joseph Dixon Crucible Co., Jersey City, N. J. It is a very timely talk on the use of paint, advocating the use of Dixon's silica graphite paint. The publication is argumentative in tone, stating that the natural decay of metal and wood by the elements should be met with nature's own preservative. Among the marvelous provisions of nature nothing is more wonderful than a silvery gray ore found at Ticonderoga, N. Y. This ore is a form of carbon of which diamonds are a class, and like them, is practically indifferent to chemical influence. The Joseph Dixon Crucible Co., exclusive owners of this mine, discovered some forty years ago the superior advantages of flake graphite for paint purposes. Testimonials are submitted to show that for ease of application, good covering power and effective protection for long periods of time, Dixon's silica graphite paint is unusually desirable. The publication will be sent to anyone interested in painting upon request.

The Dean Bros. Steam Pump Works, Indianapolis, Ind., have just issued a circular descriptive of the Atlantic type boiler feeders or pressure pumps. Concerning this pump the company says: "Several years ago this company was called upon to build twelve steam driven boiler feeders for salt water, marine service. It was specified that they should have a certain capacity, be of the highest grades, workmanship and material, and, in particular, be free from certain faults in design which existed in the best pumps then on the market. These faults caused more or less trouble during long periods of continuous operation. In other words, we were to supply pumping machinery for this service which would be better than the best, and when once started would continue in operation, without stopping any cause within the pumps, until the end of the voyage, whether two weeks or two months. As a result we designed and furnished the Atlantic type pump which is described in this circular. They have filled the requirements in every particular. This circular contains complete table of sizes, with complete description. It will be sent to anyone interested upon request.

NEW CRAFT LAUNCHED UNCHRISTENED.

With no wine to christen her, the new ferryboat belonging to the Key Route Company was released very recently from the ways at the United Engineering Iron Works, San Francisco, and slid unnamed into the waters of the bay. This new steamer is the fourth one built by the company within the last three years—and is the sister craft to Yerba Buena, San Jose, and San Francisco—the last named being the swiftest vessel of the class on the Pacific coast. The new and unchristened craft will be named with proper ceremonies as soon as she receives her machinery. The boat's length over all is 200 ft., 35-ft. beam, 18.6-ft. depth. The double compound engines will possess 2,000 H. P. and drive the craft at the speed of 15 knots per hour.

Work was commenced on the vessel last November, and she will be ready to go into commission Aug. 1. Another ferryboat is also being built by the Key Route Co., the keel of which was laid last December. This new craft will be launched May 1. All these boats ply between San Francisco and Oakland.

NEW DRY DOCKS AT TOLEDO.

Mr. C. B. Calder, general manager of the Toledo Ship Building Co. announces that the Great Lakes Dredge & Dock Co., of Chicago, has been awarded contract to build the new dry dock at the plant of the Toledo Ship Building Co. The new dock, which is to be completed by Oct. 15, will be 600 ft. long, 105 ft. wide at the top and 70 ft. wide at the bottom. The gate will be 80 ft. wide. This dredging company will also enlarge the present dry dock at the Toledo yard, making it 625 ft. long, 100 ft. wide at the top and 70 ft. wide at the bottom.

The crew of the fishing tug W. F. Halstead had an exciting experience Friday last when about fifteen miles out in the lake from Ashtabula. The top of the cabin caught fire and before it was discovered the life raft and a portion of the wooden awnings had been destroyed. The men had a difficult time in extinguishing the flames.

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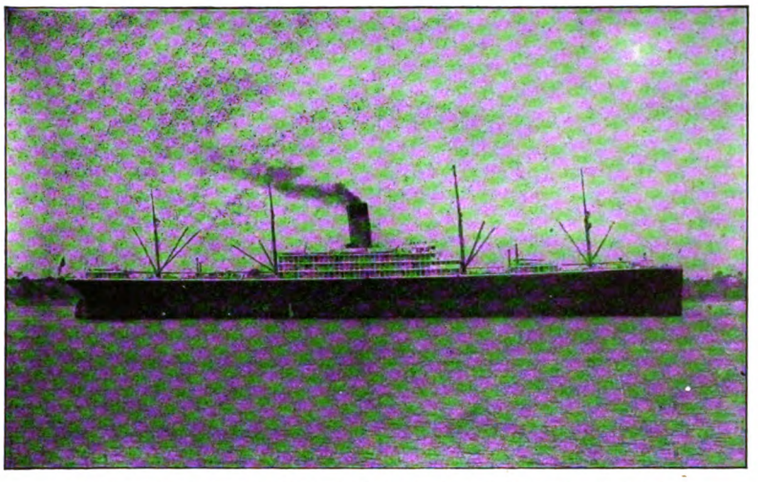
Hyde Windlasses and Capstans



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Selected for the Minnesota and Dakota of the Great Northern Steamship Co.'s fleet—the largest vessels ever built in the United States. They are also being installed on nearly all of the vessels now building for the Navy Department, Revenue Cutter service, Lighthouse Board and the United States Coast Survey.

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IRON STEEL

PIG IRON

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Cleveland, Ohio.

FERRALL'S HUB HOISTER AND Sheave for Same.

The sheaves of these hoisters are fitted with Star Metaline Bushings and Side Bearings, which keep the sheaves from heating, make them run true and together with the rounded edges of the shells, soon save more than their cost, by preserving the rope.

BOSTON & LOCKPORT BLOCK CO.

BOSTON - MASS.

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WANTED and FOR SALE Department.

PROPOSALS.

U. S. Engineer Office, Buffalo, N. Y., April 20, 1906.—Sealed proposals in triplicate for construction of stone breakwater at South Harbor Entrance, Buffalo, N. Y., will be received here until 11 A. M. May 21, 1906, and then opened. Information furnished on application. H. M. ADAMS, Col. Engrs.

U. S. Engineer Office, Duluth, Minn., April 2. 1906. Sealed proposals for building a steel tug complete, will be received here until noon May 2, 1906, and then publicly opened. Information on application. CHAS. L. POTTER, Major, Engrs.

U. S. Engineer Office, Jones Building, Detroit, Mich., April 14, 1906. Sealed proposals for dredging Round Island Shoals, St. Marys River, Mich., will be received at this office until 2 p. m. May 14, 1906, and then publicly opened. Information furnished on application. CHAS E. L. B. DAVIS, Col., Engrs.

WANTED

Scows Wanted.

For work on Lake Huron, three scows 30 to 40 feet wide, 130 to 150 feet long.

H. E. TALBOTT & CO., Dayton, Ohio.

Marine Railway

WANTED: A Marine Railway of 1,000 tons capacity. Send particulars to D. G. DOBSON, Box 83, Midland, Ont.

Wanted.

Lighter to carry 1,000 tons. Two second-hand McMyler hoists with chain sheets.

Address LIGHTER,
care Marine Review.

FOR SALE.

Steamer

FOR SALE: "Welland" Canal sized wooden steamer. Box 97, care THE MARINE REVIEW.

Coal Buckets.

Twenty-six long 5-ton Coal Buckets in good condition.

M. A. HANNA & CO,
Ashtabula, O.

For Sale.

One American Ship Windlass No. 3 Towing Machine, complete with cable.

Address GEO. W. PFOHL,
No. 30 Ohio St., Buffalo, N. Y.

A Bargain.

Steamer "Huntress," built in 1880, tonnage 114, length 110 ft., beam 18 ft., draft 7½ ft., carries 215 passengers. Hull and boiler in good condition. For sale at a bargain. Apply for information to SMITH, DAVIS & CO., 200 Main St., Buffalo, N. Y.

For Sale.

One Boiler 16 ft. by 6½ ft. Marine Fire Box, allowed 100 lbs steam.

Address GEO. W. PFOHL,
No. 30 Ohio St., Buffalo, N. Y.

Marine Railway

FOR SALE.—Marine Railway 1,000 tons capacity, Boat Railway, 45 rods land, about 170 feet water front buildings. Two boilers, one is new, machinery and sawmill, etc. ABRAM CHACE, 507 Kempton St,, New Bedford, Mass.

FOR SALE.

For Sale.

One Upright Engine 14 x 16, Hall's build, in first-class shape, with wheel and shaft. Address GEO. W. PFOHL,
No. 30 Ohio St., Buffalo, N. Y.

Lumber Barge.

For sale cheap, Lumber Barge; capacity five hundred and eighty thousand. For full particulars inquire Box 96, MARINE REVIEW, Cleveland, O,

For Sale.

Five Scotch Boilers, allowed 160 lbs. steam. Good as new. ERIE MACHINERY CO., 729 Garfield Bldg., Cleveland, O.

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Steamer E. F. Gould, length 137 ft., width 28 ft , depth 8 ft. 5 in , tonnage 261 tons. Boiler, engine and hull in good condition. First-class, complete sand pumping outfit now installed on boat, will sell with boat if so desired. Apply

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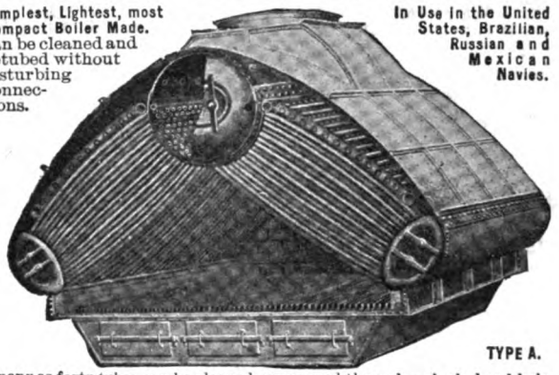

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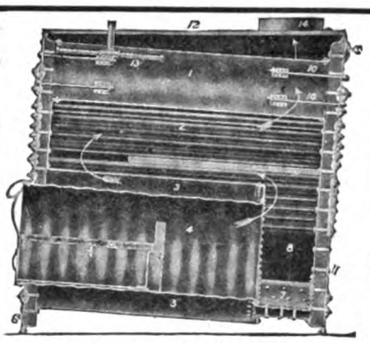

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Half the weight of ordinary Scotch boilers.

Standard corrugated furnaces.

Patent applied for. Investigate before buying any other.

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Free circulation type.

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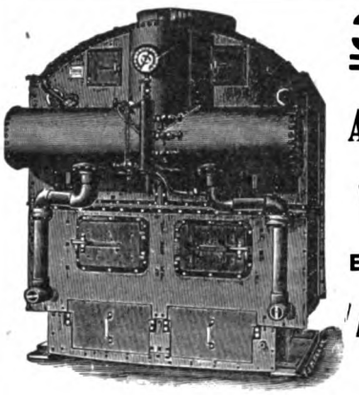

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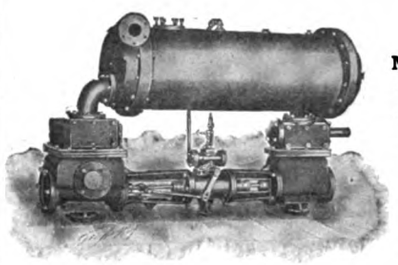

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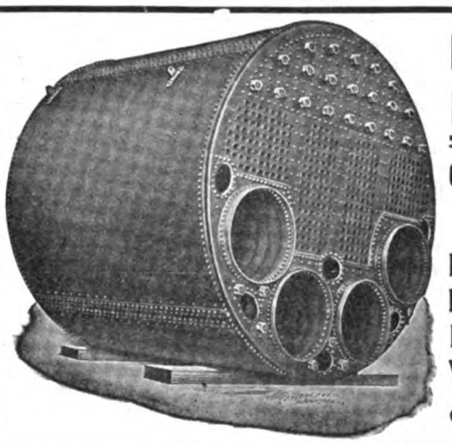

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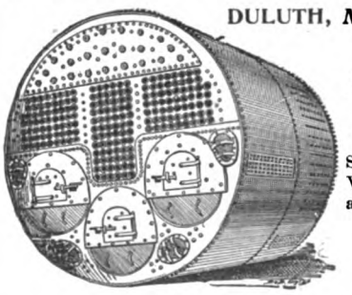

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See accompanying index of Advertisers for full addresses of concerns in this directory.

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Dearing Water Tube Boiler Co.....Detroit.
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Fore River Ship & Engine Co..Quincy, Mass.
Great Lakes Engineering Works.....Detroit.
Lunkenheimer Co.....Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co.....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co.
..... Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A. .....New York.
Upson-Walton Co.....Cleveland.
Republic Belting & Supply Co.....Cleveland.

CAPSTANS.
American Ship Windlass Co..Providence, R. I.
Dake Engine Co.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

CHAIN CONVEYORS, HOISTS.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co....Boston, Mass.
Republic Belting & Supply Co.....Cleveland, O.

CHARTS.
Penton Publishing Co.....Cleveland.

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons.....Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.

COAL AND ORE HANDLING MACHINERY.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.

COMPASSES.
Ritchie, E. S. & Sons.....Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works.....Detroit.
Thropp & Sons Co., John E..Trenton, N. J.

CONTRACTORS FOR PUBLIC WORKS.
Breymann & Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Graves & Stephens..... Cleveland.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W.....Saginaw, Mich.
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Standard Contracting Co..... Clevelnad
Sullivan, M.....Detroit.

CORDAGE.
Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

CORK JACKETS AND RINGS.
Armstrong Cork Co.....Pittsburg, Pa.
Kahnweiler's Sons, D.....New York.

CRANES, TRAVELING.
Brown Hoisting Machinery Co.....Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..... ... New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Fitz-Simons & Connell Co.....Chicago.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W.....Saginaw, Mich
Smith Co., L. P. & J. A.....Cleveland.
Starke Dredge & Dock Co., C. H..Milwaukee.
Sullivan, M.....Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.....New York.

DRY DOCKS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....Chicago.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.
Lockwood Mfg. Co.....East Boston, Mass.
Milwaukee Dry Dock Co.....Milwaukee.
Newport News Ship Building Co.....
.....Newport News, Va.
Shipowners Dry Dock Co.....Chicago.
Superior Ship Building Co....Superior, Wis.
Tietjen & Lang Dry Dock Co.....Hoboken, N.J.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....Manitowoc, Wis.

DYNAMOS.
General Electric Co.....Schenectady, N. Y
Thropp & Sons, John E.....Trenton, N. J.

ELECTRIC HOISTS AND CRANES.
General Electric Co.....Schenectady, N. Y.

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G. H. Breymann & Bro's

CONTRACTORS FOR
PUBLIC WORKS

Dredging, Dock Building, Etc.

5, 6 AND 7 MARINE BUILDING
TOLEDO, OHIO.

GRAVES & STEPHENS

PUBLIC WORK CONTRACTORS

Dredges
Derrick Scows
Pile Drivers
Lighters
Concrete Plants

Commercial Bank Bldg. CLEVELAND, O.

Buffalo Dredging Co.

GENERAL CONTRACTORS
ON
SUBMARINE WORK

Office
D. S. Morgan Bldg. BUFFALO, N. Y.

GREAT LAKES DREDGE & DOCK CO.

OWNS AND OPERATES THE PLANTS OF THE FORMER COMPANIES:

Lydon & Drews Co.
Hausler & Lutz Co.
Green's Dredging Co.
Chicago Star Con. & D. Co.
McMahon & Montgomery Co.
Chicago Dredging & Dock Co.
Griffith, McDermott & Watt Dredging Co.
Duluth Dredge & Dock Co.
Lake Superior Contracting & Dredging Co.

Contractors for
RIVER AND HARBOR IMPROVEMENTS.
Main Office: 1319-1322 Chamber of Commerce - CHICAGO

DUNBAR & SULLIVAN DREDGING CO.
BUFFALO, N. Y.

Ready for Spring A New Tool

A REVOLVING CLAMSHELL DREDGE

which will do the following impossibilities to the ordinary dredge:

Excavate 60′ back from face of dock into scow or vice versa. Excavate at either end of itself and dump in scow at other end. This makes through cutting and cleaning narrow slips cheaply possible. Excavate trenches to 150′ or more depth. Excavate material and throw it one side 150′ from original site where there is four feet of water between dump and channel. Excavate shallow channels down to 4′ x 44′. Clean out boulders or obstructions without disturbing surrounding bottom. Excavate close to docks without injury to dock. Anything that ordinary derrick will do up to 10 tons at 75′ radius.

This is an excellent wrecking tool.

Hickler Brothers

SAULT STE. MARIE, MICH.

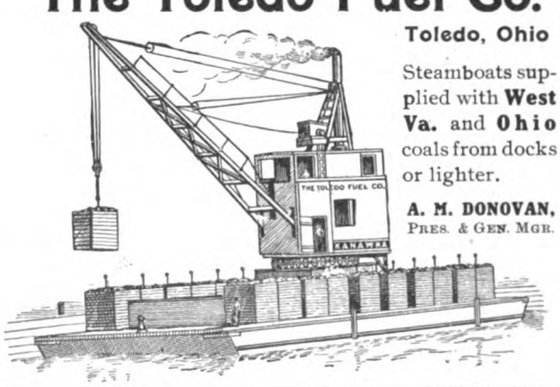
MARINE RAILWAY

Capacity, 1,000 tons. Draft, 7½ ft. forward, 13½ ft. aft. Length on keel blocks, 180 ft.; over all, 190 ft.

Machine Shop, Foundry and Steam Forge, Dredges, Drill Boats and Derrick Scows.

The Toledo Fuel Co.

Toledo, Ohio



Steamboats supplied with **West Va.** and **Ohio** coals from docks or lighter.

A. M. DONOVAN,
PRES. & GEN. MGR.

H. W. HUBBELL CO.

Submarine Work
of all kinds

Dredging Hard Material a Specialty.

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Buyers' Directory of the Marine Trade.—*Continued.*

ELECTRIC LIGHT AND POWER PLANTS.
General Electric Co.....Schenectady, N. Y.
Thropp & Sons, John E.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Chicago Ship Building Co.....Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Ship Building Co.....Detroit.
Fletcher, W. & A. Co.....Hoboken, N. J.
Fore River Shipbuilding Co....Quincy, Mass.
Great Lakes Engineering Works.Detroit, Mich.
Hall Bros. .....Philadelphia.
Lockwood Mfg. Co.....East Boston, Mass.
Maryland Steel Co.....Sparrows Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co.....
.....Newport News, Va.
New York Shipbuilding Co....Camden, N. J.
Nortnwestern Steam Boiler & Mfg. Co...
..... Duluth, Mich.
Quintard Iron Works Co.....New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co....Superior, Wis.
Thropp, J. E. & Sons Co.....Trenton, N. J.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH, CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co.....New York.

ENGINEERING SPECIALTIES AND SUPPLIES.
Lunkenheimer Co. .....Cincinnati.
Northwestern Steam Boiler & Mfg. Co...
..... Duluth, Minn.

ENGINEERS, MARINE, MECHANICAL, CONSULTING.
Hynd, Alexander .....Cleveland.
Hunt, Robt. W. & Co.....Chicago.
Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Roelker, H. B. .....New York.
Wood, W. J. .....Chicago.

FEED WATER PURIFIERS AND HEATERS.
Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.
Ross Valve Co.....Troy, N. Y.

FIXTURES FOR LAMPS, OIL OR ELECTRIC.
General Electric Co.....Schenectady, N. Y.

FORGES.
Sutton Co., C. E.....Toledo, O.

FORGINGS FOR CRANK, PROPELLER OR THRUST SHAFTS, ETC.
Cleveland City Forge & Iron Co...Cleveland.
Fore River Shipbuilding Co.....Quincy, Mass.
Macbeth Iron Co.....Cleveland.

FLUE WELDING.
Fix's, S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
Hanna, M. A. & Co.....Cleveland.
Ironville Dock & Coal Co.....Toledo, O.
Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co.....Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.....Detroit.

FURNACES FOR BOILERS.
Continental Iron Works.....New York.

GAS BUOYS.
Safety Car Heating & Lighting Co..New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. .....Cincinnati.

GAUGES, WATER.
Lunkenheimer Co. .....Cincinnati, O.

GENERATING SETS.
General Electric Co.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J

GREASE EXTRACTORS.
Greacen-Derby Engineering Co.....
.....Perth Amboy, N. J.

HAMMERS, STEAM.
Chase Machine Co.....Cleveland.

HEATING APPARATUS.
Sutton Co., C. E.....Toledo, O.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting Machinery Co. (Inc.)....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co..... Grand Haven, Mich.
General Electric Co.....New York.
Georgian Bay Engineering Works.....
.....Midland, Ont.
Hyde Windlass Co.....Bath, Me.
Marine Iron Co.....Bay City.

HOLLOW SHAFTINGS, IRON OR STEEL.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co...Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works.....Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....New York.

ICE MACHINERY.
Great Lakes Engineering Works.....Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros. .....New York.
Lunkenheimer Co.....Cincinnati.
Penberthy Injector Co.....Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago.
Fleming & Co., E. J.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A.....Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F..New York & Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

IRON CASTINGS.
Sutton Co., C. E.....Toledo, O.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

LIFE PRESERVERS, LIFE BOATS, BUOYS.
Armstrong, Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson .....Buffalo.

LOGS.
Nicholson Ship Log Co.....Cleveland.
Walker & Sons, Thomas....Birmingham, Eng.
Also Ship Chandlers.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph..Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. .....Cincinnati

LUMBER.
Martin-Barriss Co.....Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros.....Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc.....Philadelphia.

MARINE RAILWAYS.
Hickler Bros.....Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co.....Detroit.
Great Lakes Engineering Works.....Detroit.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
The National Metallic Packing Co....Oberlin, O.

MOTORS, GENERATORS—ELECTRIC
General Electric Co.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Benjamin Farnum How.....Boston
Ritchie, E. S., & Sons.....Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland.
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland.
Wood, W. J. .....Chicago.

OAKUM.
Stratford, Oakum Co.....Jersey City, N. J.

OIL ENGINES.
Mietz, Aug. .....New York.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph..Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros. .....New York.
Katzenstein, L. & Co.....New York.
The National Metallic Packing Co....Oberlin, O.
Republic Belting & Supply Co.....Cleveland, O.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co. .....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc.....Philadelphia.

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